Southwestern Wyoming...

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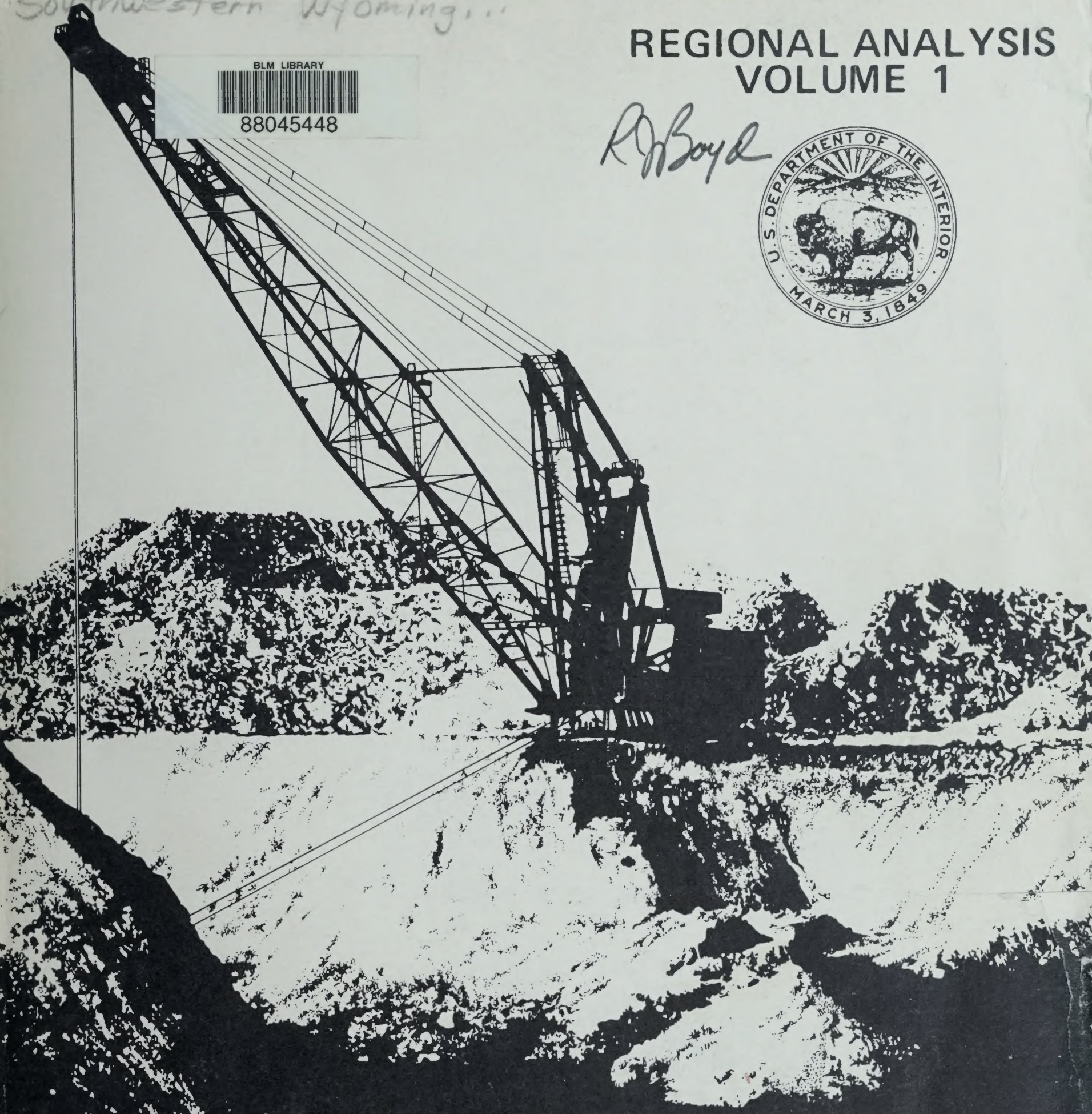
REGIONAL ANALYSIS
VOLUME 1

R J Boyd



Final

ENVIRONMENTAL STATEMENT

Development of Coal Resources in Southwestern Wyoming

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DEPARTMENT OF THE INTERIOR

FINAL

ENVIRONMENTAL STATEMENT

PROPOSED

DEVELOPMENT OF COAL RESOURCES

IN

SOUTHWESTERN WYOMING

Prepared by the

DEPARTMENT OF THE INTERIOR

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Director, Bureau of Land Management
Washington, D. C.

SUMMARY

Draft ( ) Final (x) Environmental Statement

Department of the Interior, Bureau of Land Management

1. Type of Action: Administrative (x) Legislative( )

2. Brief Description of Actions: The proposed actions are based on five formal proposals for mining federal coal in southwestern Wyoming. This environmental statement is developed in two parts: (1) an analysis of cumulative impacts of potential coal developments in the region and (2) site-specific mining and reclamation plan analyses.
Involved are:

A. approval of five mining and reclamation plans on existing leases;

B. issuance of 13 rights-of-way on public lands for support facilities related to the above, including 4 rights-of-way for 19.9 miles of railroad spurs, 3 rights-of-way for 5.2 miles of road, 5 rights-of-way for 25.4 miles of power and telephone lines, and 1 right-of-way for 2.5 miles of conveyor.

Annual production estimates total 10.8 million tons by 1980, 15.2 million tons by 1985, and 15.2 million tons by 1990. Combined with existing mining expected to continue, a total of 31.2 million tons would be produced annually by 1990.

3. Summary of Environmental Impacts by 1990:

A. Land surface would be lowered from 0 to 30 feet on 3,680 acres where coal is mined underground.

B. Approximately 353 million tons of coal would be extracted.

C. Some fossils would be destroyed, others would be exposed.

D. Water quality may be lowered, total dissolved solids would increase.

E. Industrial and municipal use of water would increase by 5,040 acre-feet per year; water would be available for other uses.

F. Air quality would be lowered in terms of all presently regulated pollutants, and visibility would be reduced. The most serious impact will result from fugitive dust emissions from strip mines. However, these emissions are not included in the comparison to state and federal standards and, as a result, no TSP standards are violated. Maximum predicted concentrations of carbon monoxide, nitrogen oxides, sulfur dioxide, and hydrocarbons would be less than 10% of the federal and state standards.

G. Vegetation on 15,917 acres would be disturbed. On the 11,785 acres proposed for strip mining, destruction of soil horizons would occur, resulting in decreased soil productivity, permeability, and infiltration rates. Increased erosion and sedimentation rates may occur. All but 435 acres of the 15,917 acres would be reclaimed by reestablishment of vegetation. About 274 acres would be occupied by approved livestock/wildlife ponds and 161 acres by permanent structures (a relocated highway and a railroad spur).

H. Wildlife habitat, carrying capacity, and populations would be lost on 15,917 acres and adversely affected on 71,626 acres of terrestrial habitat.

I. Livestock and wildlife forage would be reduced by 9,333 animal unit months during mining.

J. Five sites eligible for the National Register of Historic Places within or adjacent to project boundaries would be subjected to temporary visual impacts during mining activities. Some archeological sites would be destroyed, and some would be salvaged.

K. On some areas the present agricultural land use would be converted to urbanization.

L. The present visual quality of the landscape would be changed as a result of mining and the consequent construction of roads, railroad and transmission lines, mine structures, and urban developments.

M. The recreational use demand in and adjacent to the region would increase as the population increases. This increased use would degrade the primitive quality recreational experience which is characteristic of the region.

N. Social support facilities would not keep pace with population increases. Small towns would lose their small-town atmosphere. Social disorders would increase in larger towns.

O. All transportation arteries including rail lines would experience increased average daily traffic with increased accident and delay potential occurring at intersections with rail crossings.

P. A total employment increase of 42% would reduce unemployment but lead to a population increase in the region.

Q. Increased wages and investment in the area would increase personal income, retail sales, and property values; however, it could result in hardships to persons on fixed incomes.

R. Population of the region would increase by 7,199 as a result of the proposed actions.

4. Alternatives Considered: Four alternatives are presented in Chapter 8: the No-Action Alternative, the Fish and Wildlife Mitigation Alternative, the Defer Federal Action Alternative, and the Socioeconomic Mitigation alternative. In addition, two scenarios are presented, a Low Scenario, based on 16 million tons of coal production by 1990 without the proposed actions, and a High Scenario, based on 35.6 million tons of coal production by 1990 including the proposed actions. Since the No-Action Alternative and the Low Scenario are based on the same production level they are presented together.

5. Comments on the draft environmental statement were requested from various agencies, state clearing house, and interest groups. See attached.

6. Date draft statement was made available to EPA and the public: 7 April 1978.
Date final statement was made available to EPA and the public: 31 August 1978.

Comments on the draft environmental statement were requested from the following agencies, state clearing house, and interest groups

Federal

Advisory Council on Historic Preservation*
U.S. Department of Agriculture
  Soil Conservation Service*
  Forest Service*
U.S. Department of Commerce*
U.S. Department of Energy*
U.S. Department of Health, Education, and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
  Bureau of Mines
  Bureau of Reclamation*
  U.S. Fish and Wildlife Service*
  Heritage Conservation and Recreation Service*
  National Park Service*
  Office of Surface Mining*
U.S. Department of Labor
  Mine Safety and Health Administration*
  Occupational Safety and Health Administration
U.S. Department of Transportation*
U.S. Environmental Protection Agency*
Federal Energy Regulatory Commission*
Federal Highway Administration
Interstate Commerce Commission
Mountain Plains Federal Regional Council
Office of Economic Opportunity
Water Resources Council

State

State of Wyoming Clearing House* coordinated comments from all interested state agencies

Local

Lincoln County Commissioners
Lincoln/Uinta Counties Planning Office
Mayors
  City of Rock Springs
  Town of Evanston
  Town of Green River
  Town of Kemmerer
Sweetwater County Commissioners
Sweetwater County Planning and Zoning Commission*
Sweetwater County Priorities Board
Uinta County Commissioners

Nongovernment Organizations

Alpine Chapter Audubon Society
American Horse Protective Association
American Electric Power Service Corporation
American Fisheries Society*
American Institute of Mining Engineers
American Mining Congress
American Sportman's Club
Arch Mineral Corporation*
Black Butte Coal Company*
Citizens for a Better Environment*
Cumberland Coal Company*
Defenders of Wildlife*
ENACT
Environmental Citizen's Lobby
FMC Corporation*
Friends of the Earth
International Society for the Protection of Mustangs and Burros
Izaak Walton League
  Kemmerer Boosters
League of Women Voters
National Audubon Society
National Council of Public Land Users
National Energy Law and Policy Institute
National Environmental Health Association
National Resources and Environmental Council
National Wildlife Federation
National Resources Defense Council
Northern Great Plains--Sierra Club
Powder River Basin Resource Council
Rock Springs Gem and Mineral Club
Rocky Mountain Energy Company*
Society for Range Management
Southwest Wyoming Industrial Association*
Sun Energy Development Company
Sweetwater County Historical Society
The Kemmerer Coal Company*
The Wilderness Society*
The Wyoming Wildlife Federation*
Trout Unlimited
Union Pacific Railroad Company*
Utah Power and Light Company*
Western Wyoming Wonder Wheelers
Wild Horse Organized Assistance
Wild Horses Yes*
Wyoming Outdoor Council
Wyoming Petroleum Association
Wyoming Stockgrowers Association
Wyoming Woolgrowers Association

*Agencies and organizations which delivered hearings testimony and (or) submitted written responses concerning draft ES.

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FOR

SOUTHWESTERN COAL ENVIRONMENTAL

STATEMENT

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CHAPTER 1

DESCRIPTION OF THE PROPOSAL

BACKGROUND

The scope of this regional analysis includes the cumulative impacts of all coal developments proposed for federal approval, the continuance of mines previously authorized on existing leases, the development of private coal mines requiring no federal authorizations, and other developments occurring or expected to occur within the Southwestern Wyoming Coal Environmental Statement (ES) region. It analyzes the impacts of federal, state, and private actions that, if fully implemented or adopted as discussed herein, could lead to the production of 31.2 million tons of coal per year by 1990 from the region. Regional impacts are assessed at three points in time (1980, 1985, and 1990).

The ES region is defined as the principle impact area of the coal-related developments analyzed in this ES (see Figure R1-1). The geographic ES region, consisting of approximately 6.3 million acres, includes all of Uinta and portions of Lincoln and Sweetwater Counties, Wyoming. The principle communities are Evanston, Kemmerer/ Diamondville, Green River, and Rock Springs, Wyoming. The boundaries of the ES region are colinear with planning area boundaries within the Rock Springs District of the Bureau of Land Management (BLM).

Transportation networks would cause only significant impacts that were identified as extending beyond the principle ES region; these impacts are analyzed to the extent that they are significant.

This ES was prepared by the BLM and the Geological Survey (USGS) in cooperation with the U.S. Fish and Wildlife Service and the Bureau of Mines.

This ES does not propose new coal leasing nor does it commit the Secretary of the Interior to a new coal-leasing program or to the issuance of new coal leases.

The mining and reclamation plans discussed in this statement were submitted for review prior to the promulgation of 30 Code of Federal Regulations (CFR) 700 required under Section 502 of the Surface Mining Control and Reclamation Act (SMCRA) of 1977 (PL 95-87) and have not been reviewed for compliance therewith. Therefore, the mining and reclamation plans may not reflect the requirements of the initial regulations. However, in this statement the applicable initial regulations are considered as a required federal mitigating measure and are being included as a federal requirement in Chapter 1.

The mining and reclamation plans will be returned to the operators together with a request that they be revised in accordance with the applicable initial regulations. As soon as the mining and reclamation plans are revised and returned to the USGS, they will be evaluated with the Office of Surface Mining to determine compliance with the requirements of 30 CFR 211 and 700. Prior to approval, an updated environmental assessment will be done.

Three of the mine plans submitted for review propose leaving highwalls and benches in accordance with the criteria set out in Section 527, Special Bituminous Coal Mines, of SMCRA. However, prior to mine plan approval, each plan will be reviewed to see if it meets the location requirements in relation to the existing mine as set out in Section 527.

Any future coal-related actions beyond those proposed and analyzed in this statement may require additional assessment of environmental impacts.

Future National Environmental Policy Act Review Points

1. Future requests for right-of-way permits or coal lease applications which meet short-term standards would have to be reviewed.
2. SMCRA requires mining permits to be reviewed to determine if they should be renewed at a minimum of every 5 years.
3. Future mining and reclamation plans on existing leases would have to be reviewed.
4. Future changes in approved mining and reclamation plans would have to be reviewed.
5. Under the Act of 1977, the Department of Energy was authorized to set coal production rates on federal coal leases, review and concur on stipulations included in federal coal leases, and establish diligence requirements for each lease. Guidelines and procedures are being developed for coordination of the Department of Energy's responsibilities with those of the Department of the Interior.
6. Preference right lease applicants were required to prepare an initial showing indicating evidence of commercial quantities of coal. Initial showings were submitted by July 1977. They will be evaluated in technical and environmental assessments to be prepared jointly by the BLM and the USGS.

Recent interpretation of the Mineral Leasing Act of 1920 has determined that areas of federal coal under preference right lease application cannot be leased if there exists on that area a prior valid existing mining claim under the Mining Act of 1872. Preference right lease applicants were required to submit abstracts of any

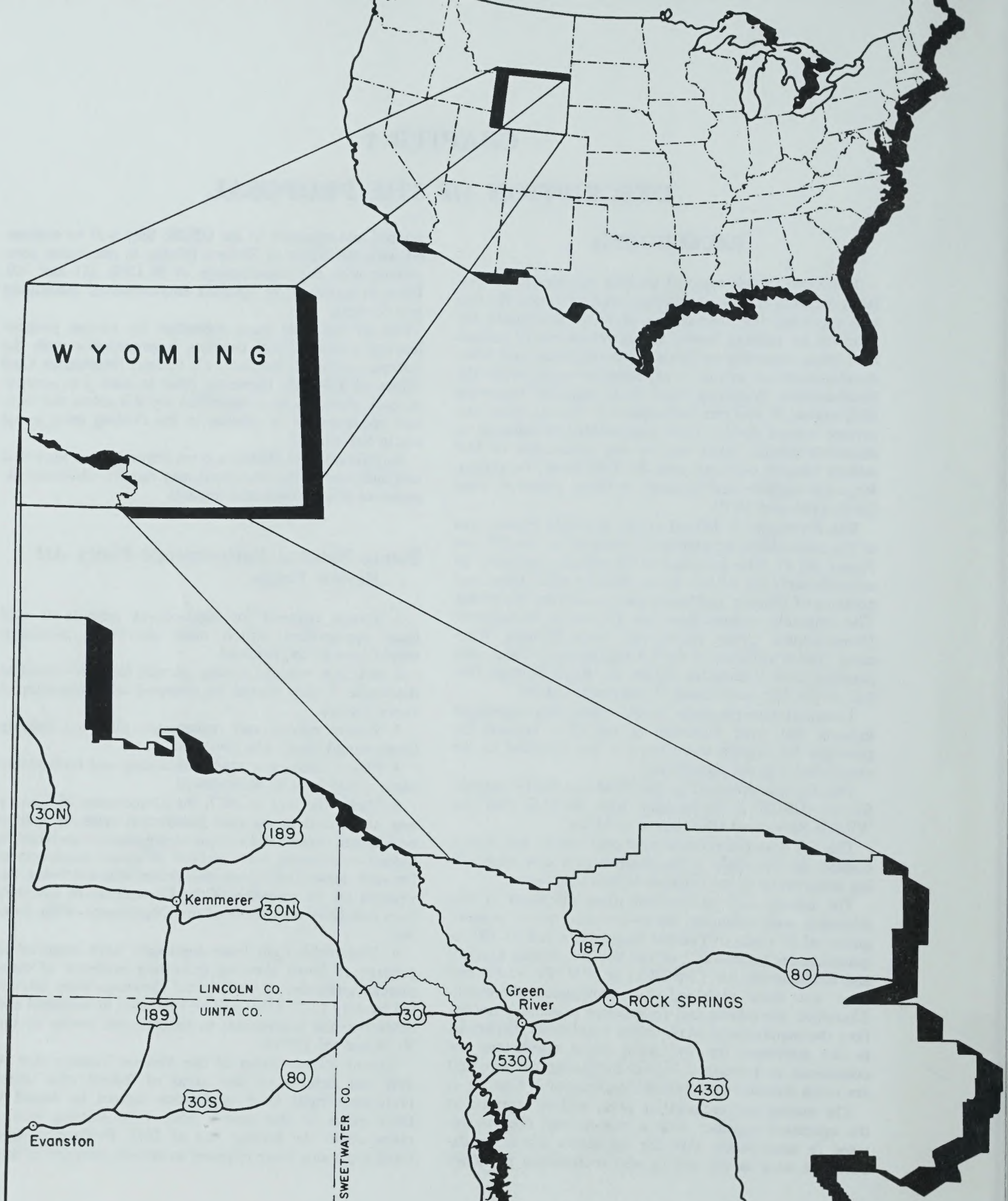


Figure R1-1
GENERAL LOCATION OF REGIONAL ENVIRONMENTAL STATEMENT
SOUTHWESTERN WYOMING

mining claims found on their application area by March 1978.

On 27 September 1977, the Department of the Interior was enjoined from issuing any new coal leases until a supplemental coal programmatic ES correcting the deficiencies of the original statement has been issued in final form and a new coal management program has been developed. Therefore, the existing preference right lease applications cannot be issued until this injunction is lifted.

PROPOSED ACTIONS

The proposed actions are to consider for approval five coal mining and reclamation plans on existing leases and the issuance of rights-of-way necessary to develop those five proposed coal mines. Table R1-1 summarizes the proposed actions.

Approve Mining and Reclamation Plans

Each of the proposed mines is a new mine operation involving development of issued federal leases. The proposed mines are North Block Mine, Twin Creek Mine, South Haystack Mine, Long Canyon Mine, and Black Butte Mine. Surface ownership on the five proposals includes 34,008 acres of public land, 45,906 acres of private land, and 1,440 acres of state land--totaling 81,354 project acres containing 357 million tons of recoverable coal reserves (see Table R1-2 for more detailed data). Complete descriptions of these proposals may be found in the appropriate site-specific ESs. The mining and reclamation plans for these five proposed coal mines have been accepted by the Area Mining Supervisor of the USGS for analysis of environmental impacts under 30 CFR 211 (May 1976).

North Block Mine (Kemmerer Coal Company)

On 25 July 1975, a mining and reclamation plan (Kemmerer Coal Company 1975) to conform with 30 CFR 211 (May 1976) was submitted to the USGS to develop a surface coal mining operation on federal lease numbers W-0294513, W-056471, W-060274, and W-075207, including approximately 2,473 surface acres (2,153 public and 320 private) 5 miles northwest of Kemmerer, Wyoming (see Map 1, Appendix A, for location). The company proposes to produce 1.4 million tons per year. Generating Unit 4 of the Utah Power and Light Company's Naughton Power Plant is the expected market for this coal. The operation would be an open-pit mine and would cause disturbance on approximately 2,591 acres (includes disturbance from all sources) of land surface by 1990.

Twin Creek Mine (Cumberland Coal Company)

On 25 January 1977, a mining and reclamation plan (Rocky Mountain Energy Company 1976), revised from the original plan of July 1976 to conform to 30 CFR 211 (May 1976), was submitted to the USGS to develop a surface coal mining operation on federal lease W-075207. The mining and reclamation plan includes approximately 2,841 surface acres (835 public and 2,006 private) located 3 miles west of Kemmerer, Wyoming (see Map 1, Appendix A, for location). The Cumberland Coal Company proposes to produce 2.5 million tons per year to supply customers in Idaho, Oregon, Washington, and (or) other markets from an open-pit mine that would disturb approximately 1,932 acres (includes disturbance from all sources) by 1990.

South Haystack Mine (Cumberland Coal Company)

On 13 January 1977, a mining and reclamation plan (Cumberland Coal Company 1977) revised to conform to 30 CFR 211 (May 1976) was submitted to the USGS to develop a surface coal mining operation on federal lease W-060241. The mining and reclamation plan includes 8,080 surface acres (3,010 public, 4,430 private, and 640 state) located 25 miles southwest of Kemmerer, Wyoming (see Map 1, Appendix A, for location). The Cumberland Coal Company proposes to produce 3 million tons per year to supply customers in Nevada and the Pacific Northwest from an open-pit mine that would disturb approximately 2,720 acres (includes disturbance from all sources) by 1990.

Long Canyon Mine (Sunoco Energy Development Company and Rocky Mountain Energy Company)

On 28 January 1977, a mining and reclamation plan (Sunoco Energy Development Company and Rocky Mountain Energy company 1977) revised to conform to 30 CFR 211 (May 1976) was submitted to the USGS covering proposed underground coal production from their federal lease W-0313201. The mining and reclamation plan includes 31,360 surface acres (15,080 public, 15,640 private, and 640 state) located 21 miles north of Rock Springs, Wyoming (see Map 1, Appendix A, for location). The Sun Energy Development Company and the Rocky Mountain Energy Company propose to produce 2 million tons per year to supply markets on the East Coast and in the Pacific Northwest. The operation would utilize traditional room and pillar mining where necessary, but with longwall mining being the preferred method to be used where feasible. Approximately 493 acres would be disturbed from all sources by 1990.

Black Butte Mine (Black Butte Coal Company)

On 14 February 1977, a mining and reclamation plan (Black Butte Coal Company 1977) revised to conform to 30 CFR 211 (May 1976) was submitted to the USGS to

Table R1-1

PROPOSED ACTIONS--SOUTHWESTERN WYOMING

Map Ref. No.	Mine Name	MINE AND RECLAMATION PLAN APPROVALS: Type of Mine	Total Acres In Mine Plan	Production By 1990 (MM Tons/Yr.)	Mine Life (Yrs.)	RIGHT-OF-WAY APPROVALS: Type	Miles Public	Miles Total	Acres Public	Acres Total
1	North Block	Surface	2,473	1.4	35	Power (34.5 kv)/telephone line	4.5	5.5	54	66
						Conveyor	2.5	4.5	125	149
2	Twin Creek	Surface	2,841	2.5	16	Railroad spur[1]	1.7	2.6	46	70
						Overburden storage area	---	---	160	160
3	South Haystack	Surface	8,080	2.5 to 3.5	22	Power (138 kv)/telephone line	8.0	24.0	96	288
						Haul Road	0.2	2.2	3	45
						Railroad spur	12.0	25.0	288	600
4	Long Canyon	Underground	31,360	2.0	33	Power (34.5 kv)/telephone line	3.0	6.0	36	72
						Road (access)	3.0	6.0	42	84
						Railroad spur	4.0	7.0	96	168
5	Black Butte	Surface	36,600	6.3	26	Power (34.5 kv)/telephone line[2](2)	9.9	13.4	29	39
						Road (access)[2]	2.0	3.0	36	54
						Railroad spur	2.2	4.5	45	95
						Water truck filling station	---	---	9	9
						Relocation 230-kv power lines	3	100	72	240
						Relocation gas pipelines	1.2	3.2	21	58
Totals			81,354	14.7 to 15.7		5 Power/telephone lines	25.4	48.9	215	465
						1 Conveyor	2.5	4.5	125	149
						3 Roads	5.2	11.2	81	183
						4 Railroad spurs	19.9	39.1	475	933

[1]This railroad spur has already been approved by BLM.

[2]Total area necessary for access including required federal rights-of-way.

Table R1-2

MOST PROBABLE LEVEL OF DEVELOPMENT OF EXISTING,
PROPOSED, AND PROJECTED MINES IN SOUTHWESTERN WYOMING BY 1990

Map Reference	Names	Type of Mine	Total Recoverable Reserves (MM Tons)	Annual Coal Production (MM Tons/Year) 1977	1980	1985	1990
	Proposed actions, 5 mines						
1	North Block Mine	Surface	54	0	0.0	1.4	1.4
2	Twin Creek Mine	Surface	40	0	2.5	2.5	2.5
3	South Haystack Mine	Surface	54	0	1.5	3.0	3.0
4	Long Canyon Mine	Underground	63	0	0.5	2.0	2.0
5	Black Butte Mine	Surface	146	0	6.3	6.3	6.3
	Subtotal		357	0	10.8	15.2	15.2
	Existing mines						
A	South Block Mine	Surface	83	3.5	3.5	3.5	3.5
B	Skull Point Mine	Surface	27	1.2	1.2	1.2	1.2
C	Stansbury Mine	Underground	19	0.5	1.0	1.0	1.0
D	Rainbow-Columbine Mine	Underground	NA	0.0	0.0	0.3	0.3
E	Bridger Mine	Surface	210	5.3	7.5	7.5	7.5
	Subtotal			10.5	13.2	13.5	13.5
	Projected development of private coal						
F	Winton Mine	Underground	40	0	0	2.0	2.0
G	Reliance Mine	Underground	9	0	0	0.5	0.5
	Subtotal		49	0	0	2.5	2.5
	Total			10.5	24.0	31.2	31.2

NA = Not Available

Table R1-2

MOST PROBABLE LEVEL OF DEVELOPMENT OF EXISTING,
PROPOSED, AND PROJECTED MINES IN SOUTHWESTERN WYOMING BY 1990
(Continued)

Map Reference	Names	TIME POINTS: Start Construction	TIME POINTS: Full Mine Operation	TIME POINTS: Mine Life (Years)	ACRES: Total Project Acres[1]	ACRES: Federal Coal Lease Acres	ACRES: Total Surface Acres to Be Mined[1,2]	ACRES: Average Acres Disturbed Per Year[1,2]
	Proposed actions, 5 mines							
1	North Block Mine	1980	1983	35	2,473	2,936	1,711	69
2	Twin Creek Mine	1978	1980	16	2,841	306	733	107
3	South Haystack Mine	1978	1981	22	8,080	1,408	1,041	94
4	Long Canyon Mine	1978	1981	33	31,360	14,680	0	13
5	Black Butte Mine	1978	1980	26	36,600	14,902	10,560	509
	Subtotal				81,354	34,232[4]	14,045	792
	Existing mines							
A	South Block Mine	1963	1965	35	2,779	0		50
B	Skull Point Mine	1975	1977	20	746	3,201[3]	426	21
C	Stansbury Mine	1975	1977	20	4,194	0	0	3
D	Rainbow-Columbine Mine	1959	Closed	unknown	4,965	0	0	0
E	Bridger Mine	1974	1978	30	20,600	8,436	4,826	160
	Subtotal				33,284	11,637	5,252	234
	Projected development of private coal							
F	Winton Mine	1983	1985	20	11,558	0	0	2
G	Reliance Mine	1983	1985	17	8,934	0	0	2
	Subtotal				20,492	0	0	4
	Total				135,130	45,869	19,297	1,030

[1]Includes mine pits only.
[2]Includes public, state, and private.
[3]Federal lease will not be mined before 1986.
[4]Not all lease acres included in project areas of specific mines.

Table R1-2

MOST PROBABLE LEVEL OF DEVELOPMENT OF EXISTING,
PROPOSED, AND PROJECTED MINES IN SOUTHWESTERN WYOMING BY 1990
(Continued)

Map Reference	Names	EMPLOYMENT 1980 Const.	1980 Perm.	1985 Const.	1985 Perm.	1990 Const.	1990 Perm.	Estimated Number and Direction of Market Unit Trains for the Year[4] 1980	1985	1990	Market Area
	Proposed actions, 5 mines										
1	North Block Mine	50	0	0	200	0	200	N/A	N/A	N/A	Local Power Generation
2	Twin Creek Mine	100	300	0	300	0	300	100E/150W	100E/150W	100E/150W	ID, OR, WA, and markets
3	South Haystack Mine	180	130	0	260	0	260	---/150W	---/300W	---/300W	E. NV and Pacific NW
4	Long Canyon Mine	100	125	0	400	0	400	25E/ 25W	100E/100W	100E/100W	E. Coast & Pacific NW
5	Black Butte Mine	150	221	0	320	0	320	330E/300W	330E/300W	330E/300W	Illinois and Idaho
	Subtotal	580	776	0	1,480	0	1,480	455E/625W	530E/850W	530E/850W	
	Existing mines										
A	South Block Mine	0	535	0	535	0	535	N/A	N/A	N/A	Local Power Generation
B	Skull Point Mine	0	100	0	100	0	100	N/A	N/A	N/A	Local Trona Plant
C	Stansbury Mine	0	240	0	240	0	240	N/A	N/A	N/A	MT, WA, CO, and NE
D	Rainbow-Columbine Mine	0	0	0	87	0	87	None	Unknown	Unknown	Local Use
E	Bridger Mine	0	260	0	260	0	260	N/A	N/A	N/A	Local Power Generation
	Subtotal	0	1,135	0	1,222	0	1,222				
	Projected development of private coal										
F	Winton Mine	0	0	0	125	0	125	None	---/200W	---/200W	ID, OR, and NV
G	Reliance Mine	0	0	0	270	0	270	None	50E/---	50E/---	NE and KS
	Subtotal	0	0	0	395	0	395		50E/200W	50E/200W	
	Total	580	1,911	0	3,097	0	3,097				

[4]Assumes one unit train equals 100 cars, each train having a capacity of 10,000 tons of coal. Does not include return traffic.

W = Westbound
E = Eastbound

N/A = Not Applicable

develop a surface coal mining operation on a portion of federal lease W-6266. The mining and reclamation plan includes approximately 36,600 surface acres (12,930 public, 160 state, and 23,510 private) located 25 miles east of Rock Springs, Wyoming (see Map 1, Appendix A, for location). The Black Butte Coal Company proposes to produce approximately 6.3 million tons per year to supply power generation plants in Illinois (3.3 million tons) and Idaho (3 million tons). The operation would be a surface mine and would disturb approximately 14,245 acres (includes disturbance from all sources) by 1990.

Issue Rights-of-Way

Rights-of-way to cross public lands would be necessary for construction of power lines, railroad spur lines, telephone lines, access and haul roads, and a conveyor system, all of which are included in the site-specific analyses of the five proposed mining and reclamation plans listed above. Table R1-1 identifies and quantifies these support developments.

REQUIRED AUTHORIZATIONS

This section identifies governmental authorizations which would be required to fully implement the five proposed mines.

A memorandum of understanding is in preparation which describes operating procedures to be followed by the BLM, the Office of Surface Mining, and the USGS concerning their areas of responsibility in the federal coal management program. This memorandum of understanding may alter the agency responsibilities listed below.

Federal

Geological Survey (USGS)

The Area Mining Supervisor of the USGS must approve the mining and reclamation plan prior to commencement of mining operations by a company.

Bureau of Land Management (BLM)

The BLM must concur with the mining and reclamation plan before approval is granted by the USGS. BLM is also responsible for granting various rights-of-way for ancillary facilities such as access roads, power lines, communication lines, and railroad spurs on public lands.

State of Wyoming

Under an agreement with the Secretary of the Interior, the Wyoming Department of Environmental Quality must approve the mining and reclamation plan which has been approved by the federal government and must also issue the necessary permits and licenses to mine and reclaim under its statewide responsibilities.

REGIONAL DEVELOPMENT SUMMARY

Coal Development

Three levels of coal development are analyzed in this regional ES (Figure 1-2). The most probable level of development is analyzed in Chapter 4. Low and high level scenarios are analyzed in Chapter 8, and a comparison of these with the most probable level is shown in Chapter 8.

The most probable level of development includes production from the five proposed mines whose approval constitutes the proposed actions, continuation of production from existing mines, and projected development of privately-owned coal requiring no federal action (see Table R1-2).

Coal-Related Development

The following coal-related developments are analyzed because they are cumulative with the impacts of the proposed actions.

Naughton Power Plant, Units 4 and 5

The Utah Power and Light Company plans to enlarge its electrical generating capacity by adding two units to the Naughton plant located 5 miles southwest of Kemmerer, Wyoming. An Environmental Analysis Record, Utah Power and Light Complex, was completed 26 July 1976 for the needed rights-of-way across public lands. Impacts were assessed in accordance with BLM, Department of the Interior, and Environmental Protection Agency requirements. It was determined that an ES was not required.

The planned facility would consist of two additional 430 megawatt (Mw) coal-fired, water-cooled generating units to be adjacent to the existing Naughton plant. The existing plant consists of three units with capacities of 160, 220, and 330 Mw. The first of the proposed new 430 Mw units is scheduled for service in 1983 and the second in 1985.

The new units would require about 9,200 gallons per minute of makeup water, or about 14,800 acre-feet per year. Depletion from this use is estimated to be 12,900 acre-feet per year. This water would be diverted from the Hams Fork via the present Viva Naughton Reservoir which would be enlarged from its present capacity of 42,393 acre-feet to 90,000 acre-feet. Enlargement of Viva Naughton would require approximately 30 additional surface acres of public land for which application has been made. Delivery of the water from the Hams Fork

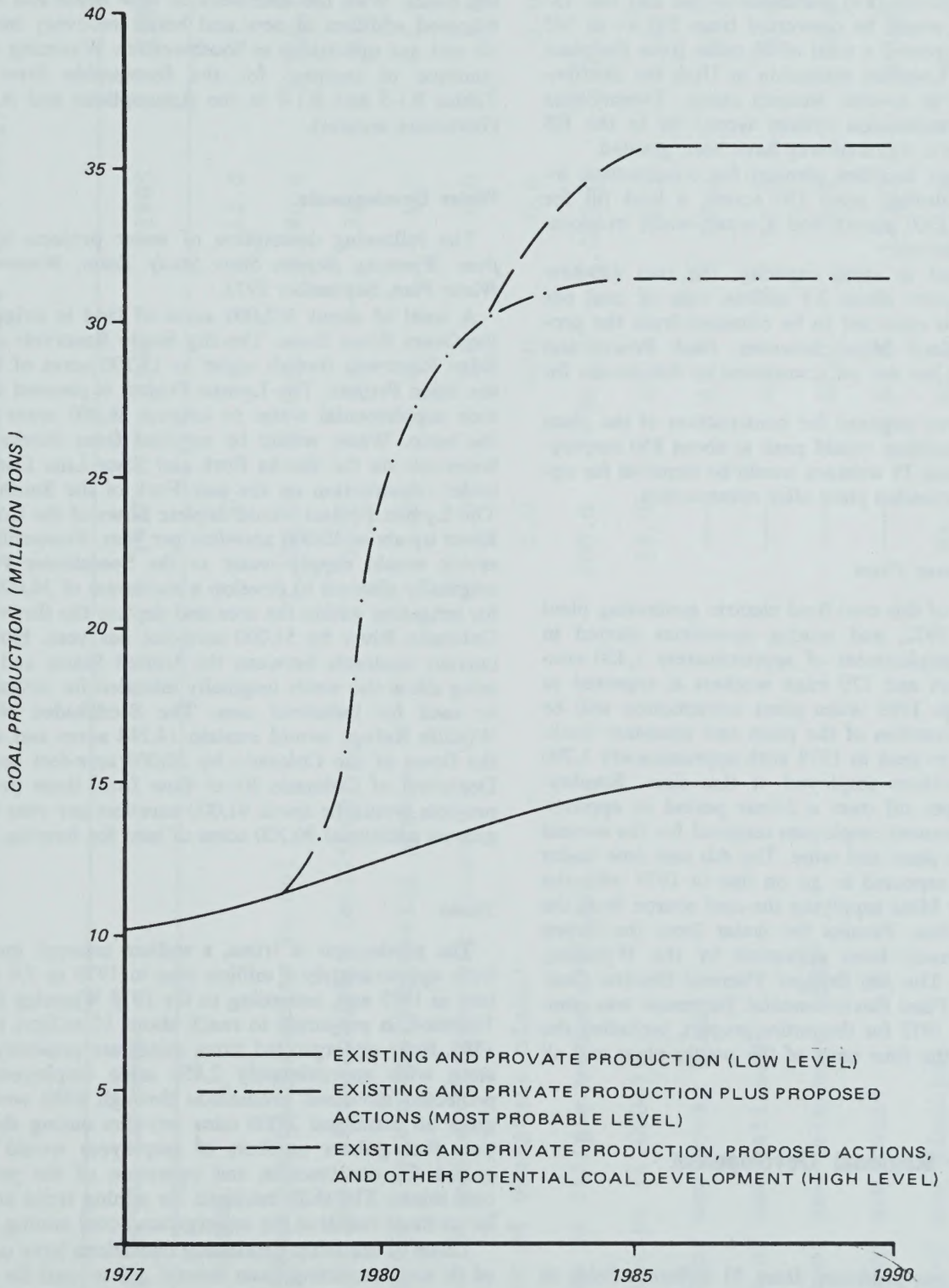


Figure R1 - 2

PROJECTED SOUTHWESTERN WYOMING COAL PRODUCTION

to the plant would require construction of a new 36-inch water line adjacent to an existing water line in an existing transportation corridor.

A railroad spur about 1.6 miles long would be constructed, and about 1 mile of existing dirt road would be upgraded and paved.

A new 345-kilovolt (kv) transmission line and two existing lines that would be converted from 230 kv to 345 kv would carry power a total of 88 miles from the plant site to the Ben Lomond substation in Utah for distribution to utilities in several western states. Twenty-nine miles of this transmission system would be in the ES region, and federal rights-of-way have been granted.

Attendant plant facilities planned for construction include a water storage pond (30 acres), a land fill for sludge and ash (300 acres), and a waste-water evaporation pond (100 acres).

When operated at rated capacity, the two 430-Mw units would require about 2.8 million tons of coal per year. The coal is expected to be obtained from the proposed North Block Mine; however, Utah Power and Light Company has not yet committed to this source for the coal.

The work force required for construction of the plant and attendant facilities would peak at about 850 employees in 1981. About 75 workers would be required for operation of the expanded plant after construction.

Jim Bridger Power Plant

Construction of this coal-fired electric generating plant was begun in 1972, and mining operations started in 1973. Current employment of approximately 1,350 construction workers and 170 mine workers is expected to continue through 1980 when plant construction will be complete. Construction of the plant and attendant facilities is expected to peak in 1978 with approximately 1,700 construction workers employed at that time. Employment would taper off over a 2-year period to approximately 420 permanent employees required for the normal operation of the plant and mine. The 4th unit now under construction is expected to go on line in 1979 with the existing Bridger Mine supplying the coal source from the current production. Permits for water from the Green River have already been approved by the Wyoming State Engineer. The Jim Bridger Thermal Electric Generation Project Final Environmental Statement was completed 28 April 1972 for the entire project, including the strip mine and the four units of the power plant and all related facilities.

Other Major Regional Development

Oil and Gas

Oil and gas was produced from 51 different fields in southwestern Wyoming in 1975. The ES region produced approximately 3% of the 135.9 million barrels of oil produced in the state of Wyoming in 1975. It also produced 28% of the 6.8 trillion cubic feet of natural gas produced in Wyoming that year.

New starts in oil and gas exploration and drilling increased by 12% in southwestern Wyoming during 1976 and are expected to further increase through 1990. This should result in the discovery of more fields and producing zones. With the discovery of new fields and the anticipated addition of new and better recovery methods, oil and gas operations in southwestern Wyoming should continue to increase for the foreseeable future (see Tables R1-3 and R1-6 in the Assumptions and Analysis Guidelines section).

Water Developments

The following description of water projects is taken *from Wyoming Report, State Study Team, Western U.S. Water Plan*, September 1973.

A total of about 303,000 acres of land is irrigated in the Green River Basin. The Big Sandy Reservoir and the Eden Reservoir furnish water to 17,100 acres of land in the Eden Project. The Lyman Project is planned to provide supplemental water to irrigate 36,000 acres within the basin. Water would be supplied from Meeks Cabin Reservoir on the Blacks Fork and State Line Dam now under construction on the east Fork of the Smith Fork. The Lyman Project would deplete flows of the Colorado River by about 10,000 acre-feet per year. Fontenelle Reservoir would supply water to the Seedskadee Project, originally planned to develop a maximum of 34,000 acres for irrigation within the area and deplete the flows of the Colorado River by 51,000 acre-feet per year. However, current contracts between the United States and Wyoming allow the water originally intended for irrigation to be used for industrial uses. The Seedskadee National Wildlife Refuge would contain 14,284 acres and deplete the flows of the Colorado by 20,000 acre-feet per year. Depletion of Colorado River flow from these proposed projects would be about 91,000 acre-feet per year to irrigate an additional 90,200 acres of land for farming.

Trona

The production of trona, a sodium mineral, increased from approximately 4 million tons in 1970 to 7.4 million tons in 1975 and, according to the *1976 Wyoming Mineral Yearbook*, is projected to reach about 15 million tons by 1980. Four underground trona mines are presently operating with approximately 2,850 mine employees. The projected increased production through 1980 would require an additional 3,000 mine workers during the same time that greater numbers of employees would be required for construction and operation of the proposed coal mines. The skills required for mining trona are similar to those required for underground coal mining.

Three of the trona processing operations have converted or are converting from natural gas to coal for drying the product. This coal requirement is expected to increase from an approximate one-half million tons per year in 1975 to approximately 1 million tons per year by

Table R1-3

PROJECTED CUMULATIVE DEVELOPMENT DATA FOR SOUTHWESTERN WYOMING (1977 BASE)

Existing and Projected	1977	1980	1985	1990
Coal mines	4.0	8.0	12.0	12.0
Two power plants (capacity in Mw)	2,220.0	2,720.0	3,580.0	3,580.0
Tons of coal mined annually (millions)	10.5	24.0	31.2	31.2
Number of trona mines/processing plants	4.0	4.0	4.0	4.0
Number of sodium bicarbonate plants	1.0	1.0	1.0	1.0
Number of phosphate mines[1]	1.0	0.0	0.0	0.0
Number of oil/gas wells drilled[2]	200.0	863.0	2,023.0	3,383.0
Population (1,000s)[3]	59.9	65.5	72.3	76.7
Miles of new power line[2]	---	43.0	68.0	80.0
Miles of new railroad[2]	---	40.0	50.0	50.0
Miles of new telephone line[2]	---	22.0	30.0	40.0
Miles of new road[2]	---	80.0	120.0	150.0
Miles of new pipeline	NA	66.0	852.0	1,565.0

[1]Reclamation of surface only after 1977.
[2]Includes cumulative from 1977 forward.
[3]1976 base.

NA = Not Available

1990. This coal increase is expected to come from within the region.

ASSUMPTIONS AND ANALYSIS GUIDELINES

The following narrative and tables are based on projected coal and ancillary developments for the ES region to establish parameters and guidelines for analysis of cumulative regional impacts. They are set forth here to aid the reader in following causes and effects and in interpreting the magnitude of anticipated impacts. Tables R1-3, R1-4, R1-5, and R1-6 provide a base for future revisions of impacts, based on actual development that takes place, and can be used to determine whether the actual cumulative impact is increased or decreased.

Guidelines

The following guidelines were used for analysis of impacts:

1. Cumulative regional impacts are analyzed for three time points (1980, 1985, and 1990).
2. Reclamation is considered complete when disturbed lands have been backfilled, graded, contoured, revegetated, and approved in accordance with an approved reclamation plan (Wyoming Land Quality Rules and Regulations (1975), SMCRA (1977), and the surface owner or surface managing agency).

Table R1-4

ACREAGE ASSUMPTIONS USED TO ANALYZE IMPACTS

Facility	Acres Required
Roads (2 lane, access, 175 foot right-of-way)	21 per mile
Railroad spur line (200 foot right-of-way)	24 per mile
Power line 34.5 kv	6 per mile
138.0 kv	12 per mile
Telephone right-of-way	2 per mile (usually common right-of-way with power line or road)

Note: Assumptions were used when specific data were not available for analysis.

Table R1-5

WATER REQUIREMENTS USED TO ANALYZE IMPACTS

Facility	Acre-Feet
Per million tons of coal mined	50.4
Per million tons of trona mined	7,964.0
Power plant (water-cooled)	15.0 per Mw
Per 1,000 population	200.0 per year

Table R1-6

PROJECTED REGIONAL SURFACE DISTURBANCE AND RECLAMATION
FROM ACTIVITIES OTHER THAN PROPOSED ACTIONS

Activity	1980 Cumulative Acres Disturbed	1980 Cumulative Acres Reclaimed	1985 Cumulative Acres Disturbed	1985 Cumulative Acres Reclaimed	1990 Cumulative Acres Disturbed	1990 Cumulative Acres Reclaimed
Existing coal mines	4,967	900	6,567	2,367	6,700	2,840
Existing trona	80	0	120	0	160	0
Pipeline, power line, telephone lines	4,300	0	9,300	1,800	14,300	7,300
Oil and gas exploration	6,041	0	14,161	1,500	23,681	9,500
Housing and support facilities for increased population	1,000	0	1,500	0	2,000	0
Road construction	270	0	720	0	1,170	0
Railroad construction	144	0	384	0	624	0
Existing power plant expansion	0	0	600	0	600	0
Total	16,802	900	33,352	5,667	49,235	19,640

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

This chapter consists of two parts, existing environment and future environment. The discussion of the existing environment describes the physical, biological, and cultural environmental components which constitute the environment of the Southwestern Wyoming Coal Environmental Statement (ES) region. The discussion of the future environment focuses on the same environmental components as they would be in 1980, 1985, and 1990 without federal approval of the proposed actions. These descriptions provide bases for the analyses in Chapter 4, The Environmental Impacts of the Proposed Actions.

EXISTING ENVIRONMENT

CLIMATE

The climate of the ES region is relatively cool and semiarid in the basin areas and cool but subhumid in the mountainous regions.

The ES region is within the mid-latitude belt of westerly winds. Large scale storms and associated precipitation occur most frequently during winter and early spring seasons. The mountain regions receive significantly higher amounts of precipitation than the lower elevations. Monthly mean temperatures are relatively low, and there is a large daily variation in temperature that is greatest in summer.

Specific Climatic Factors

The state of Wyoming's climatic divisions in the vicinity of the ES region and locations of the observation stations used in this analysis are shown on Figure R2-1A. Also indicated are the major topographic barriers which influence the climate of the region.

Sunshine

The station closest to the southwestern Wyoming ES region that routinely records the amount of available sunshine is at Lander, Wyoming. The percentage of possible sunshine in the basin areas of the ES region probably exceeds Lander's annual average value of 72% of the possible sunshine. On the western high plains and on the foothills of the Uinta and Wasatch Ranges (e.g., around Fort Bridger and Kemmerer), the sunshine probably nears the state annual average of 65%.

Temperature

Surface Temperature. There are wide seasonal variations in temperature in southwestern Wyoming. Based on records from 1930 through 1960, the average mean maximum temperature in the ES region (July) is about 84°F and the average mean minimum temperature (January) is about 5°F. As indicated in Tables R2-1A and R2-1B, the lowest temperature observed in the region was -60°F at Border, and the highest temperature of 104°F wasrecordedatSage.

Growing Season. The number of frost-free days between killing frosts (28°F) is shown on Figure R2-1B.

Vertical Temperature Profile. From data gathered by the National Weather Service (NWS) at Lander, Wyoming, Grand Junction, Colorado, and Salt Lake City, Utah, it is inferred that vertical temperature profiles in the ES region have the following characteristics.

Morning Soundings:

1. About 85% of all morning soundings—observation time at 5:00 A.M. Mountain Standard Time (MST)—indicate surface-based inversions.
2. Two-thirds of these inversions have an increase of temperature with height of greater than 6°F per 1,000 feet.
3. About 50% of these inversions are 800 feet or more deep.
4. Surface-based inversions occur most frequently during the summer (June through August), but the deepest inversions are most likely to occur in the winter (December through February).

Afternoon Soundings:

1. Less than 10% of the afternoon soundings—observation time 5:00 P.M. MST—have surface-based inversions.
2. More than 75% of the surface-based inversions that do occur are more than 300 feet deep but have an increase of temperature with height of less than 6°F per 1,000 feet.
3. More than 50% of the afternoon soundings which have surface-based inversions are recorded during the winter months.
4. About 25% of all afternoon soundings indicate upper-level inversions (i.e., an inversion with its base above ground level).
5. About 80% of these inversions are more than 800 feet thick.
6. The average lapse rate from the ground to the base of upper-level inversions is -5.4°F per 1,000 feet.

These characteristics are generally applicable to the ES region. However, since both Lander and Grand

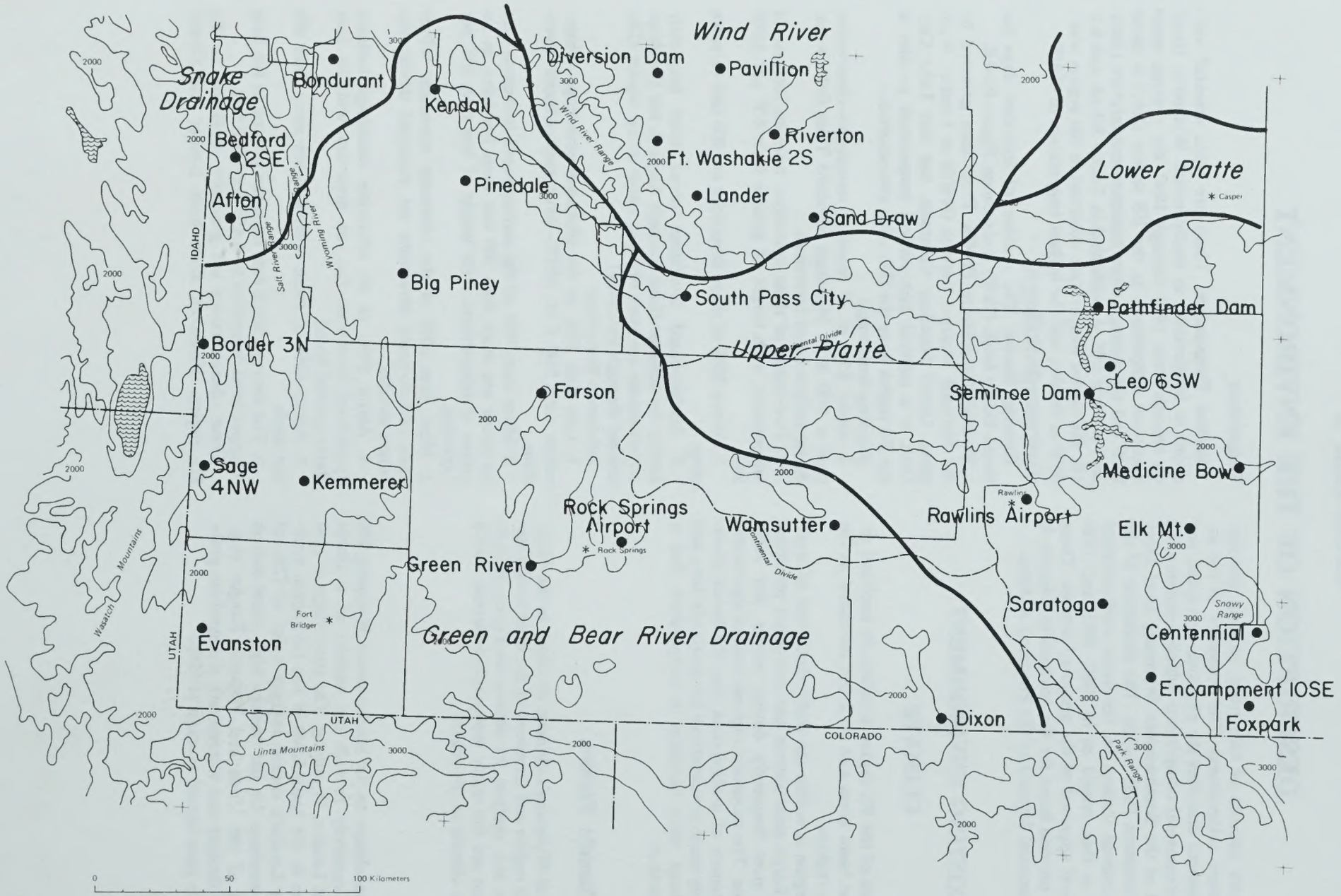


Figure R2-1A

WYOMING CLIMATIC DIVISIONS AND STATIONS USED IN REGIONAL ANALYSIS
(CONTOUR HEIGHTS ARE IN 500 METER INTERVALS)

Source: Environmental Research and Technology (ERT) 1977.

Table R2-1A

SEASONAL VARIATIONS IN TEMPERATURE

Station	Temperature (°F) Mean Max. (July)	Mean Min. (Jan.)	Highest Observed	Lowest Observed
Border[1]	84	12	102 (Jul)	-60 (Feb)
Kemmerer[1]	82	5	97 (Jun)	-32 (Feb)
Evanston[1]	81	4	94 (Jul)	-34 (Jan)
Rock Springs Airport[1]	84	8	97 (Jul)	-29 (Jan)
Wamsutter	85	7	105 (Jul)	-38 (Jan)
Farson	84	-8	94 (Jul)	-46 (Feb)
Dixon	84	4	97 (Jul)	-50 (Jan)
Sage[1]	86	-1	104 (Jul)	-47 (Jan)
Saratoga	84	8	100 (Jul)	-55 (Jan)
Seminoe Dam	84	12	97 (Jul)	-26 (Jan)

Source: ERT 1977.

Note: Data based on over 20 years of observations prior to 1960.

[1]Indicates stations in the ES region.

Table R2-1B

DAILY VARIATIONS IN TEMPERATURE

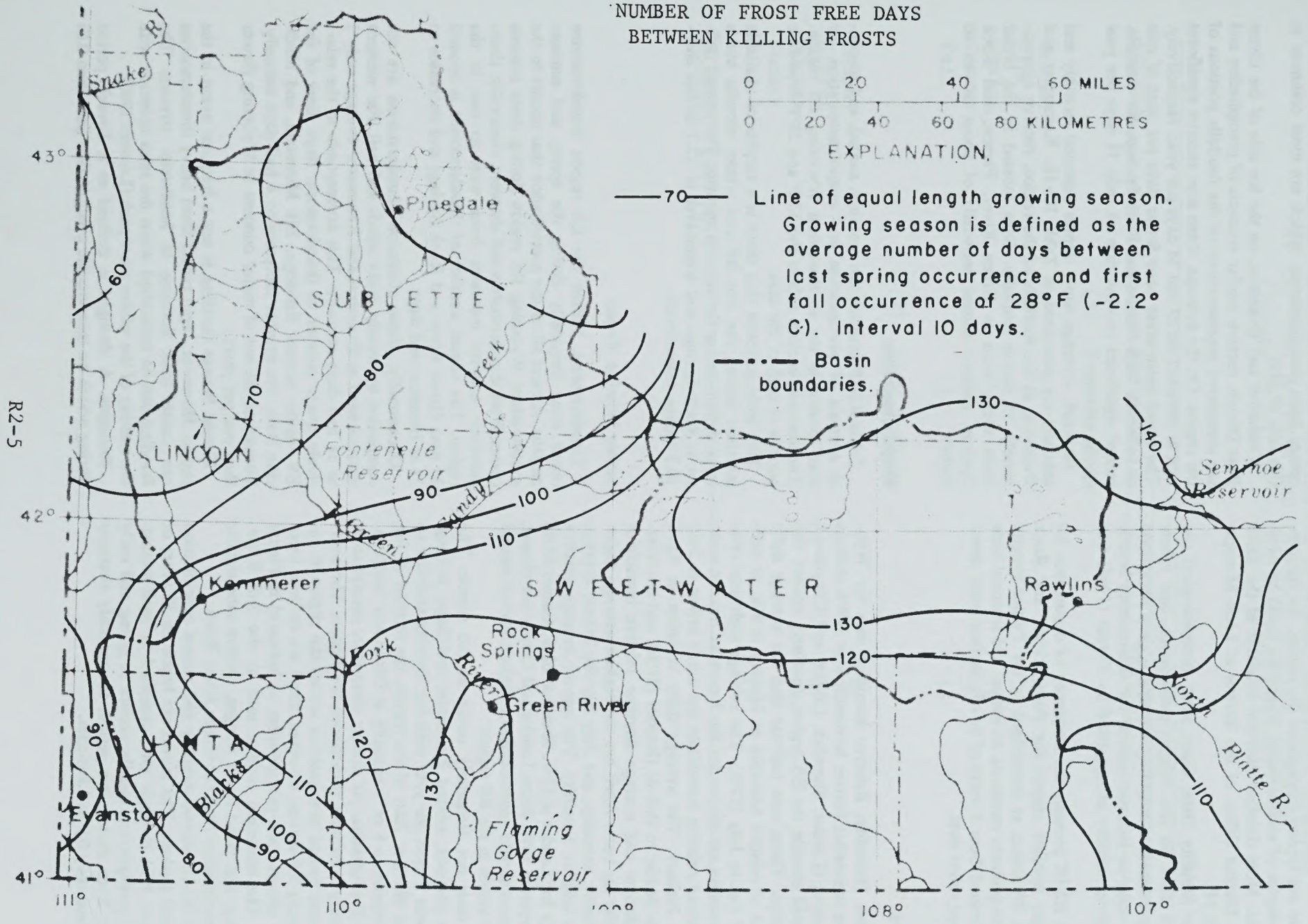
Station	Temperature (°F) Mean Max. Jan.	July	Mean Min. Jan.	July	Daily Variation Jan.	July
Border[1]	25	84	12	43	13	41
Kemmerer[1]	29	82	5	44	24	38
Evanston[1]	30	81	4	44	26	37
Rock Springs Airport[1]	29	84	8	53	21	31
Wamsutter	29	85	7	48	22	37
Farson	25	84	-8	44	33	40
Dixon	32	84	4	46	28	38
Sage[1]	29	86	-1	42	30	44
Saratoga	33	84	8	48	25	36
Seminoe Dam	30	84	12	54	18	30

Source: ERT 1977.

Note: Data based on over 20 years of observations prior to 1960.

[1]Indicates stations in the ES region.

Figure R2-1B



R2-5

Source: ERT 1977

Junction are more sheltered by large topographic barriers than are typical throughout the region, the frequency and depths of surface-based inversions could be overestimated. More detailed data are available at the Rock Springs District Office of the Bureau of Land Management (BLM).

Turner Stability Data. Since most meteorological observation sites do not release radiosondes, and where they are released a sounding analysis is only performed twice a day, an indirect method for determining hourly atmospheric stability as suggested by Turner (1964) was used.

Table R2-1C presents the frequency of occurrence for the major stability classes for Fort Bridger and Rock Springs, Wyoming, as determined by the Turner system. The table presents results on an annual and seasonal basis as determined from 5 years of hourly surface wind speed and cloud cover data.

Moisture

Relative Humidity. Relative humidity data for Wyoming are somewhat scarce; however, four NWS stations in Wyoming (Lander, Sheridan, Casper, and Cheyenne), all situated outside the ES region, routinely collect this information. These data indicate that the average daily variation of relative humidity in January is 9%, or one-third of that in July (27%). The average nighttime relative humidities are similar for the 2 months, but the average daytime relative humidities are much lower in July than in January. The average daily variation in April (24%) is similar to that in October (21%), and the average nighttime and average daytime relative humidities are similar for both. April has the highest average nighttime relative humidity, and July has the lowest average daytime relative humidity. The annual average relative humidity for Lander is 53%, Sheridan 62%, Casper 54%, and Cheyenne 56%. Since Lander and Casper are closest, their values should approximate or slightly exceed annual average values in the ES region.

Fog does not frequently occur in the region. The western portions, around Kemmerer and Sage, average only about 5 days per year with fog limiting visibility to less than 984 feet. East of the region, the number of fog days increases to 8 or 9 annually at Dixon and Saratoga.

Total Precipitation. At similar elevations, precipitation is generally consistent throughout the region. The average annual melted precipitation across the region is approximately 9.5 inches; however, there are definite topographic effects upon precipitation, as indicated in Figure R2-1C. The mountain ranges, such as the Salt River, Wyoming, and Wind River Ranges, receive substantially more precipitation than the Green River Basin.

Table R2-1D shows monthly and annual precipitation at selected stations. The means are based on 30 years of data from 1931 through 1960 compiled at each station. Highest precipitation usually occurs in spring and early summer. Even during this period, the monthly averages range from only 0.9 to 1.8 inches.

More than half of the late spring and summer rainfall comes from thunderstorms, which are most common at this time of year.

Kemmerer and Evanston, on the lee side of the Great Bear Divide, receive similar amounts of precipitation and are considered representative of the foothills portions of the region. On the average, these sites receive significant rain or snowfall on 29 and 34 days per year, respectively. The broad basin areas have fewer days per year of rain or snowfall. Both Farson and Rock Springs, for example, record significant precipitation on only 19 days per year on the average.

Snowfall. Average snow depths reported monthly and annually are presented in Table R2-1E. Kemmerer and Evanston, in the foothills of the region, receive approximately 55 inches annually. Sites located in the broad basin areas, such as Green River, Farson, and Rock Springs, receive annual snowfalls of about 20 to 40 inches.

Evapotranspiration

Table R2-1F presents the monthly, annual, and seasonal normals of precipitation and evapotranspiration for sites located in the southwestern Wyoming ES region. The seasonal periods reflect the 32°F and 28°F frost-free periods at each of the sites.

This table indicates that there is a surplus of available moisture during the late fall and winter months but a large deficit during the summer months. The annual deficit at Rock Springs and Kemmerer is -12.7 inches and -10.3 inches, respectively.

Severe Weather Events

Thunderstorms. Within the ES region thunderstorms occur most frequently during the spring and summer months. Almost all of the precipitation that occurs in the southwestern Wyoming ES region during these seasons comes from thunderstorms and showers. Generally, thunderstorm activity increases from west to east in the region. The annual number of thunderstorms is around 30 near Green River and Rock Springs and decreases to 25 at Evanston and Sage.

Occasionally, these afternoon thunderstorms are accompanied by locally gusty winds and hail. Far western stations such as Evanston and Kemmerer average only 3 to 3½ hail days annually. This corresponds to the relatively lower number of thunderstorm days. East of the ES region, around Saratoga, Elk Mountain, and Medicine Bow, the number increases to 4 hail days annually. Tornadoes are not of major concern in Wyoming (fewer than one per year).

Floods. Severe flooding is not a frequent event in the region. However, rapid runoff from heavy thunderstorms can cause flash flooding in headwater streams. The flooding can be intensified when the rains coincide with the melting of the winter snowpack (Lowers 1960).

Droughts. A drought is defined as a 2-week period during which no measureable precipitation (less than 0.01

Table R2-1C

PERCENT FREQUENCY OF OCCURRENCE OF THREE STABILITY CLASSES
AT (A) FORT BRIDGER AND (B) ROCK SPRINGS, WYOMING
(TURNER STABILITY CLASSIFICATION SYSTEM)

Period	Stability Class		
	Unstable	Neutral	Stable
(A) Fort Bridger			
Annual	13	68	19
Winter	7	79	14
Spring	10	72	16
Summer	23	54	23
Fall	12	66	22
(B) Rock Springs			
Annual	17	54	29
Winter	7	67	26
Spring	14	63	23
Summer	29	39	32
Fall	16	47	37

Source: ERT 1977.

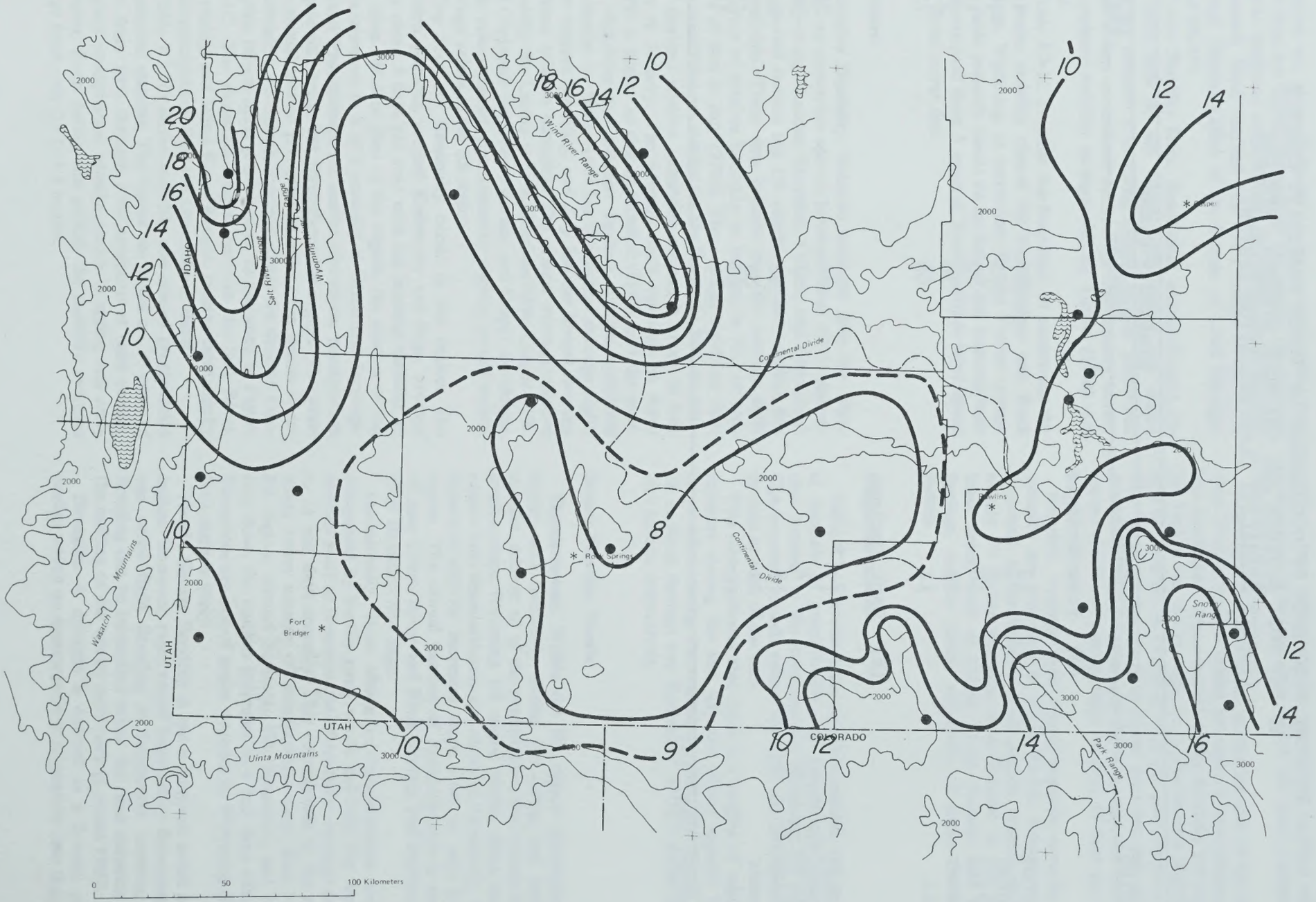


Figure R2-1C

NORMAL AVERAGE PRECIPITATION (INCHES)

Source: ERT 1977

Table R2-1D

PRECIPITATION DATA AT SELECTED STATIONS

Station	El. (ft)	Lat.	Long	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Evanston E[1]	6,860	41°16'	110°57'	0.72	0.86	0.91	1.05	1.19	1.04	0.65	0.92	0.68	0.93	0.84	0.71	10.50
Elk Mountain	7,270	41°41'	106°25'	0.72	0.86	1.33	1.58	1.39	0.98	0.84	0.93	0.94	0.82	0.77	0.63	11.79
Farson[1]	6,591	42°07'	109°27'	0.41	0.46	0.45	0.69	0.96	0.85	0.64	0.61	0.67	0.69	0.36	0.32	7.11
Border 3N[1]	6,120	42°15'	111°02'	1.24	1.13	1.04	1.13	1.30	1.28	0.77	0.81	0.84	1.17	1.06	1.23	13.00
Kemmerer[1]	6,960	41°47	110°32'	0.71	0.67	0.70	0.71	1.12	0.99	0.68	0.82	0.63	0.73	0.68	0.68	9.12
Green River	6,089	41°32'	109°29'	0.49	0.52	0.67	0.99	1.20	0.92	0.57	0.84	0.65	0.98	0.50	0.38	8.71
Sage 4NNW[1]	6,321	41°52'	111°01'	0.67	0.66	0.70	0.79	1.20	0.96	0.65	0.85	0.70	0.84	0.66	0.57	9.25
Rock Springs City	6,367	41°35'	109°13'	0.37	0.43	0.60	0.82	1.26	1.09	0.51	0.64	0.63	0.76	0.45	0.33	7.89
Rock Springs Airport[1]	6,741	41°36'	109°04'	0.47	0.61	0.63	1.03	1.12	0.79	0.63	0.73	0.74	0.96	0.57	0.40	8.68
Wamsutter 1N	6,815	41°41	107°59'	0.26	0.38	0.46	0.61	0.86	0.76	0.61	0.78	0.59	0.58	0.27	0.35	6.51
Dixon	6,364	41°02'	107°32'	0.93	0.69	1.17	1.27	1.26	0.95	1.22	1.14	0.85	1.28	0.79	1.00	12.55
Saratoga	6,786	41°27'	106°48'	0.46	0.40	0.72	0.94	1.25	1.04	0.85	0.97	0.75	0.91	0.52	0.48	9.29
Rawlins	6,736	41°48'	107°12'	0.62	0.71	0.93	1.07	1.43	0.90	0.87	0.76	0.96	0.98	0.53	0.67	10.43
Medicine Bow	6,560	41°54'	106°12'	0.58	0.60	0.80	0.98	1.60	1.30	0.98	0.79	0.86	0.82	0.58	0.55	10.44
Encampment 10 ESE	7,387	41°11'	106°37'	0.84	0.81	1.50	1.73	1.79	1.31	1.20	1.33	1.06	1.21	0.90	0.88	14.56
Leo 6SW	6,000	42°11'	106°50'	0.61	0.62	0.98	1.29	1.37	1.05	0.91	0.91	0.80	0.95	0.73	0.54	10.76
South Pass City	7,875	42°28'	108°48'	0.89	0.91	1.10	1.49	1.32	1.35	0.78	0.70	0.83	0.98	0.85	0.76	12.16
Fox Park	9,060	41°05'	106°09'	1.38	1.37	1.70	1.68	1.56	1.58	1.68	1.49	1.16	0.97	1.10	1.03	16.70
Path Finder Dam	5,930	42° 28'	106° 51'	0.29	0.37	0.63	1.12	1.59	1.18	1.03	0.88	0.83	0.86	0.49	0.30	9.57
Laramie	7,186	41° 19'	105° 35'	0.39	0.42	0.77	1.25	1.54	1.46	1.73	1.20	0.82	0.67	0.47	0.44	11.16
Afton	6,210	42°44'	110°56'	1.53	1.51	1.55	1.52	1.95	1.96	1.06	1.05	1.15	1.53	1.52	1.59	17.92

Source: ERT 1977.

Note: All stations represent at least 30 years of data. All precipitation data shown are mean.

[1]Indicates station within the ES region.

Table R2-1E

TOTAL SNOWFALL OF STATIONS IN THE SOUTHWESTERN WYOMING COAL DEVELOPMENT REGION

Station	El. (ft)	Lat.	Long.	Period of Record (years)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Border 3N[1]	6,120	42°15'	111°02'	D20	16.0	14.6	10.9	6.9	1.1	T	T	0	0.6	2.6	6.9	9.3	68.8
				G18	15.3	13.9	11.6	6.6	1.5	0.2	T	T	0.3	3.2	8.7	13.8	75.1
Dixon	6,359	41°02'	107°32'	D9	14.4	13.0	10.9	4.5	1.9	T	0	0	1.0	4.2	8.7	16.8	75.4
				G20	15.7	11.3	15.1	9.4	1.2	T	0	0	0.3	4.4	9.1	16.5	83.0
Elk Mountain	7,103	41°41'	106°25'	D24	19.9	26.7	21.7	21.5	10.4	0.1	0	0	2.7	11.3	9.8	17.7	141.8
				G17	10.6	9.6	19.2	16.8	3.7	0.7	T	T	1.1	4.6	8.8	9.4	82.5
Encampment 10 ESE	7,387	41°11'	106°37'	D19	9.7	10.7	9.1	4.4	3.1	0.1	0	0	0.6	4.8	9.0	8.7	60.2
				G22	12.2	10.7	16.1	10.8	3.0	0.1	T	0	0.9	4.1	8.8	11.1	77.8
Evanston 1E[1]	6,860	41°16'	110°57'	D32	9.6	10.2	10.6	6.0	3.3	0.2	T	0	1.1	4.3	5.9	7.2	58.4
				G19	9.8	12.8	12.5	8.0	1.9	0.4	0	0	0.9	3.7	8.9	9.4	68.3
Farson	6,600	40°07'	109°25'	D19	3.3	4.6	2.9	2.4	0.5	T	0	T	0.3	1.1	2.2	3.1	20.4
				G16	5.5	5.7	6.3	5.3	1.8	0.2	T	0	0.1	2.8	5.2	4.4	37.3
Green River[1]	6,109	41°32'	109°29'	D23	4.9	5.4	4.8	3.2	1.2	T	0	0	0.2	2.4	3.8	3.5	29.4
				G18	6.2	7.3	7.5	7.3	2.2	0.2	0	0	0.1	3.7	4.1	5.0	43.6
Kemmerer[1]	6,954	41°48'	110°32'	G15	9.3	8.6	10.1	7.2	2.1	0.6	0	0	0.4	2.7	6.7	7.7	55.4
Leo 6SW	6,000	42°12'	106°50'	D11	9.9	8.4	9.2	4.4	3.3	0	0	0	0.8	3.7	3.5	8.6	51.8
				G19	11.3	8.5	10.9	9.2	2.9	0.8	0	T	0.8	3.3	7.9	7.5	63.1
Rawlins	6,764	41°47'	107°14'	D28	7.2	8.6	9.1	6.1	2.9	0.1	0	0	0.5	4.1	5.2	9.0	52.8
				G8	10.9	9.1	9.1	2.8	2.7	T	T	T	0.8	2.7	6.5	9.0	53.6
Sage[1]	6,331	41°47'	110°58'	D8	7.3	6.9	6.5	4.9	0.8	0	0	0	0.4	2.1	6.7	5.9	41.5
				G16	6.7	6.8	6.9	5.1	1.9	0.1	T	0	0.4	2.9	5.4	7.0	43.2
Saratoga	6,794	41°30'	106°47'	D26	10.1	8.6	9.6	5.3	4.3	0.1	0	0	0.3	3.3	5.0	8.3	54.9
				G21	7.0	6.0	8.1	7.1	2.5	0.3	0	0	0.8	3.1	5.8	7.3	48.0

Table R2-1E

TOTAL SNOWFALL OF STATIONS IN THE SOUTHWESTERN WYOMING COAL DEVELOPMENT REGION
(Continued)

Station	El. (ft)	Lat.	Long.	Period of Record (years)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Wamsutter IN	6,815	41°41'	107°59'	G8	4.4	6.6	5.2	0.9	0.1	0.1	T	0	T	2.2	3.3	4.5	33.3
Rock Springs FAA AP[1]	6,741	41°36'	109°04'	37[2]	5.9	6.4	6.2	4.0	1.0	0.1	T	T	0.2	3.1	5.7	4.8	37.6

Source: U. S. Department of Commerce, Climatic summary of the U.S., supplement for 1931 through 1952, Wyoming no. 42, Washington D. C.

[1]Indicated station within the southwestern Wyoming ES region.
[2]Wyoming Natural Resources Board 1966.

D = Means or extremes for the period of record prior to 1931.
G = Means or extremes fro the period of record beginning with 1931.

Table R2-1F

NORMALS OF PRECIPITATION AND EVAPOTRANSPIRATION (INCHES)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual	Season 32°	Season 28°
Evanston 1E															
P	0.7	0.9	0.9	1.1	1.2	1.0	0.7	0.9	0.7	0.9	0.8	0.7	10.5	N	2.5
PET	0.0	0.0	0.0	1.0	2.4	3.4	4.6	4.0	2.6	1.3	0.0	0.0	19.2	N	11.7
Farson															
P	0.4	0.5	0.5	0.7	1.0	0.9	0.6	0.6	0.7	0.7	0.4	0.3	7.1	N	1.9
PET	0.0	0.0	0.0	0.9	2.5	3.7	4.8	4.1	2.5	1.1	0.0	0.0	19.6	N	11.7
Green River															
P	0.5	0.5	0.7	1.0	1.2	0.9	0.6	0.8	0.7	1.0	0.5	0.4	8.7	2.5	3.4
PET	0.0	0.0	0.1	1.3	2.8	4.1	5.3	4.6	2.9	1.4	0.0	0.0	21.6	14.7	17.7
Kemmerer															
P	0.7	0.7	0.7	0.7	1.1	1.0	0.7	0.8	0.6	0.7	0.7	0.7	9.1	N	2.9
PET	0.0	0.0	0.0	1.0	2.5	3.5	4.6	4.0	2.5	1.2	0.0	0.0	19.4	N	13.7
Rock Springs Airport															
P	0.5	0.6	0.6	1.0	1.1	0.8	0.6	0.7	0.7	1.0	0.6	0.4	8.7	2.8	3.6
PET	0.0	0.0	0.0	1.0	2.6	3.9	5.2	4.6	2.8	1.3	0.0	0.0	21.4	15.8	18.0

Source: U.S. Department of Commerce and U.S. Soil Conservation Service (updated).

P = Precipitation
PET = Evapotranspiration
N = No regular freeze-free period.

inch) occurs. Since most of the region is semiarid, droughts are not unusual. Twenty-five percent of the months each year experience severe or extreme droughts. This figure compares to values of less than 5% in places such as New England and the Pacific Northwest (Bryson and Hare eds. 1974).

High Winds. The western portion of the ES region has a maximum wind speed of 80 to 90 mph, and the central and eastern portions have a maximum speed of 90 to 100 mph.

Blizzards. Snow can fall in any portion of the ES region during the period of November through April, with the amount generally varying with elevation. Snowfalls of 10 to 15 inches or more from any one storm occur infrequently outside mountainous areas (Lowers 1960); however, blowing and drifting snow associated with stong winter winds is common. Ground blizzards also occasionally occur.

Wind

A substantial data base of surface wind statistics is not available. Five years of surface wind statistics for each of two stations are used to represent regional flow patterns. Data collected at Fort Bridger Airport, located in Uinta County, are used to indicate wind conditions in the vicinity of the proposed North Block, Twin Creek, and South Haystack Mines. Data recorded at Rock Springs Airport, in Sweetwater County, are used to show wind conditions in the vicinity of the proposed Long Canyon and Black Butte Mines.

Frequency of Wind Direction and Speed in Uinta and Lincoln Counties. Figure R2-1D presents the annual wind rose for Fort Bridger, Wyoming. (In each of the wind rose diagrams presented in this ES, wind speed categories are presented in nautical miles per hour (knots), where 1 knot = 1.15 mph.) It is based upon 5 years (1950-1954) of hourly wind observations. Fort Bridger is located in Uinta County about 35 miles east of Wyoming's western boundary at an elevation of 6,700 feet.

As indicated in Figure R2-1D, the prevailing wind direction at Fort Bridger is from the west-southwest and occurs 25% of the time. The annual average wind speed from this direction is 20 mph. The second most frequent wind direction, west, occurs more than 23% of the time and has an annual average speed exceeding 18 mph. Winds from the west-southwest through the west-northwest (236°-304°) occur about 52% of the time with an average speed exceeding 18 mph on an annual basis. The annual average wind speed for all wind directions is 15 mph.

Calm conditions (wind speed less than 2 mph) in the southwestern Wyoming region occur only 6% of the time on an annual basis. A slight seasonal variation ranges from a minimum of 5% (fall) to a maximum of 7% (winter).

Table R2-1G presents the maximum number of hours of wind directional persistence at Fort Bridger for a 5-year period (1950-1954).

Frequency of Wind Direction and Speed in Sweetwater County. Figure R2-1E presents the annual wind rose for the Rock Springs Airport, elevation 6,700 feet, about 9 miles east of Rock Springs. It, also, is based upon 5 years (1960-1964) of hourly wind observations. The prevailing wind direction is from the west-southwest and occurs 18% of the time. Winds from the southwest are the second most frequent and occur 16% of the time. On an annual basis, the three wind direction vectors of southwest through west (214°-281°) account for 50% of the hourly directional observations at Rock Springs Airport.

The annual average wind speed for all directions is 11 mph, somewhat less than the 15 mph speed characteristic of Fort Bridger. For the three predominant directional sectors, the average annual speed is 14 mph.

Calm conditions (winds less than 2 mph) occur more frequently at Rock Springs than at Fort Bridger, occurring 11% of the time on an annual basis. Seasonal variation ranges from a low of 7% in the spring to more than 13% in the fall.

Table R2-1H presents a summary of wind persistence for Rock Springs with respect to each of the sixteen wind direction sectors. It gives the maximum number of hours of wind persistance for a 5-year period (1960-1964).

AIR QUALITY

The southwestern Wyoming ES region lies within the Wyoming Intrastate Air Quality Control Region (AQCR), as designated by the U.S. Environmental Protection Agency (EPA). Currently, National Ambient Air Quality Standards (NAAQS) exist for total suspended particulates (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), photochemical oxidants, and nitrogen oxides (NO_x). Additionally, there is a federal guideline for ambient nonmethane hydrocarbon (HC) levels. The State of Wyoming also has air quality standards, which include regulations applicable to all of the above pollutants, as well as settleable particulates, coefficient of haze, sulfates, hydrogen sulfide, and fluorides.

The activities associated with the proposed mining would generate both vehicular emissions, fugitive dusts, uncontaminated soil particulates, and other stationary source particulates. Vehicular emissions could alter ambient CO, NO_x, HC, and SO_2 levels; and particulate emissions would have an impact on ambient TSP levels. The gaseous emissions associated with proposed mining activities should have their greatest impact closest to the mines. However, the proposed expansion of the Naughton Power Plant and the expansion of the Jim Bridger Power Plant could affect the ambient levels of SO_2 and NO_x in addition to those for TSP. Consequently, the following analysis of present air quality will primarily address the ambient concentrations of TSP, since each activity (the mining and burning of coal as well as increased vehicular travel) can have a direct impact on the environmental levels of this pollutant. A less detailed analysis of the existing levels of the gaseous pollutants SO_2 and nitrogen dioxide (NO_2), in particular, will be given to describe expected baseline concentrations throughout the ES region.

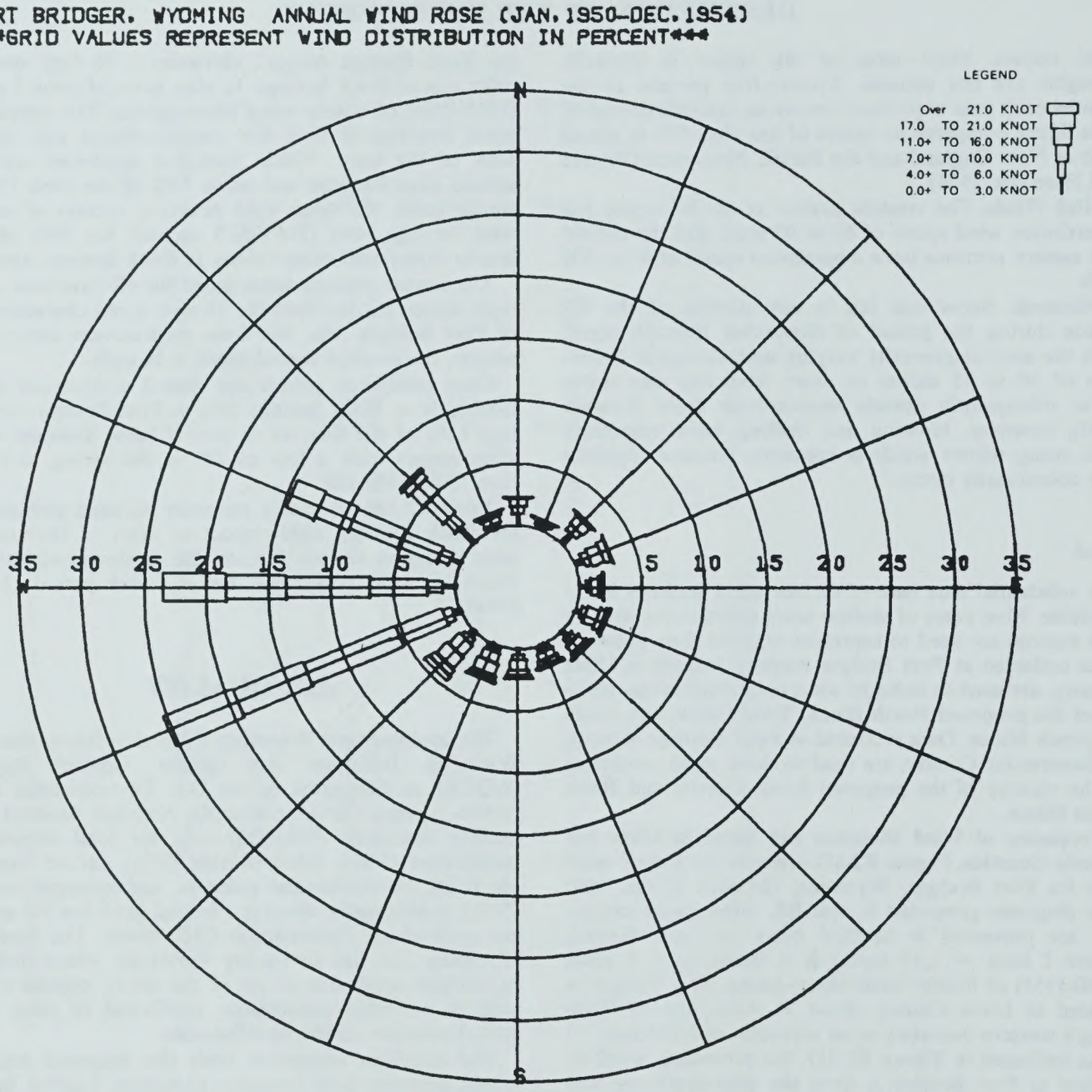

FORT BRIDGER. WYOMING ANNUAL WIND ROSE (JAN.1950-DEC.1954)
GRID VALUES REPRESENT WIND DISTRIBUTION IN PERCENT
LEGEND
Over 21.0 KNOT
17.0 TO 21.0 KNOT
11.0+ TO 16.0 KNOT
7.0+ TO 10.0 KNOT
4.0+ TO 6.0 KNOT
0.0+ TO 3.0 KNOT
N
S
35 30 25 20 15 10 5
5 10 15 20 25 30 35

Figure R2-1D

ANNUAL WIND ROSE FOR FORT BRIDGER

Source: ERT 1978.
Note: 1 knot = 1.15 mph

Table R2-1G

MAXIMUM NUMBER OF HOURS OF WIND PERSISTENCE AT FORT BRIDGER, WYOMING

Wind Direction Sector	Wind Persistence (hours)		
	< 5 mph	5-9 mph	> 9 mph
N	6	4	4
NNE	0	4	3
NE	4	6	6
ENE	4	7	6
E	7	7	7
ESE	4	13	14
SE	7	5	7
SSE	3	4	8
S	4	6	6
SSW	2	4	9
SW	5	5	15
WSW	9	14	61
W	7	15	57
WNW	13	11	14
NW	16	16	15
NNW	2	4	4

Source: ERT 1977.

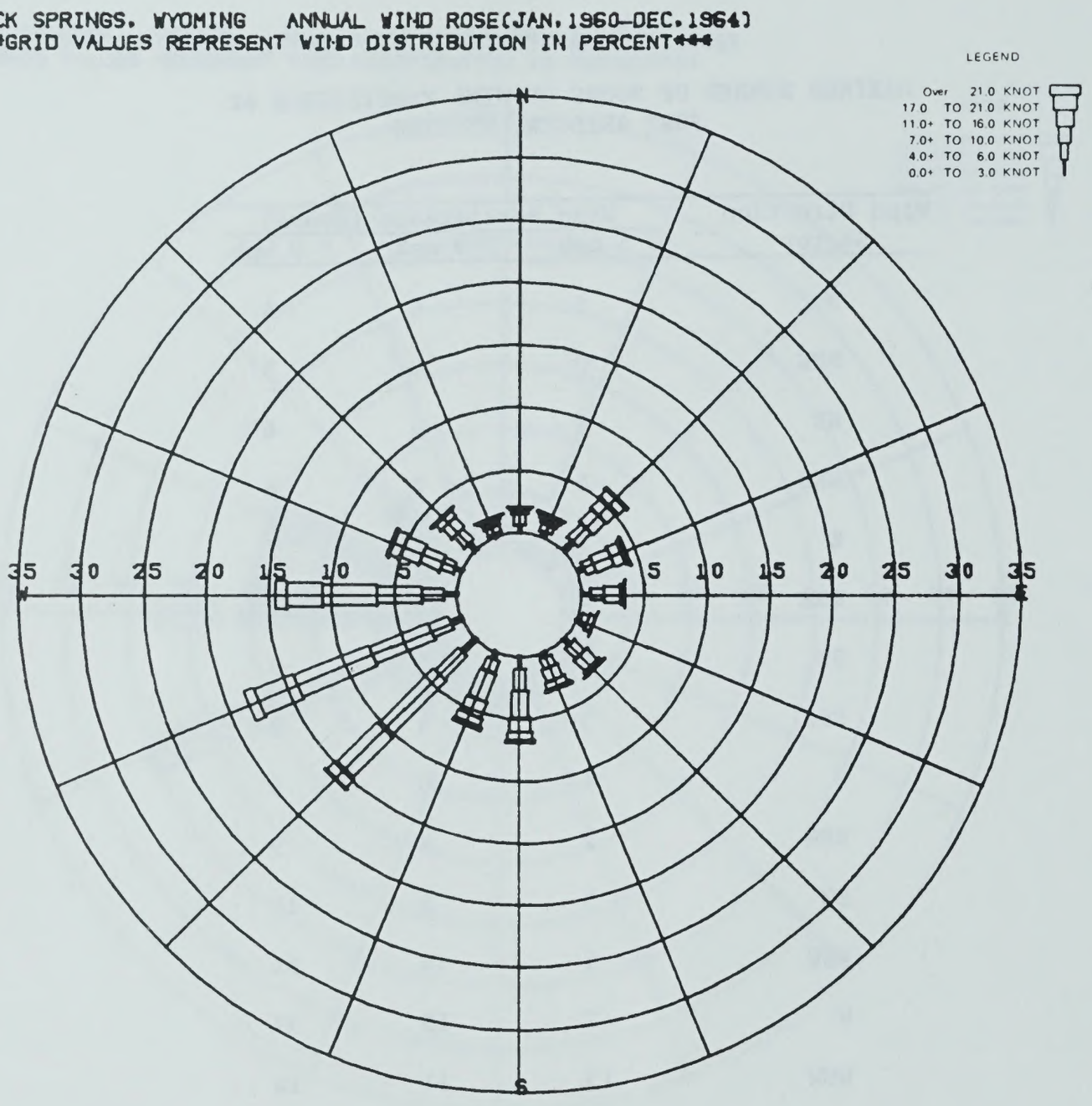

ROCK SPRINGS, WYOMING ANNUAL WIND ROSE(JAN.1960-DEC.1964)
GRID VALUES REPRESENT WIND DISTRIBUTION IN PERCENT
LEGEND
Over 21.0 KNOT
17.0 TO 21.0 KNOT
11.0+ TO 16.0 KNOT
7.0+ TO 10.0 KNOT
4.0+ TO 6.0 KNOT
0.0+ TO 3.0 KNOT
N
S
35 30 25 20 15 10 5
5 10 15 20 25 30 35

Figure R2-1E

ANNUAL WIND ROSE FOR ROCK SPRINGS

Source: ERT 1978.
Note: 1 knot = 1.15 mph

Table R2-1H

MAXIMUM NUMBER OF HOURS OF WIND PERSISTENCE AT ROCK SPRINGS, WYOMING

Wind Direction Sector	Wind Persistence (hours)		
	< 5 mph	5-9 mph	> 9 mph
N	4	4	4
NNE	4	5	10
NE	8	10	32
ENE	6	9	16
E	6	11	9
ESE	6	4	4
SE	5	9	8
SSE	6	6	6
S	13	11	12
SSW	5	4	12
SW	10	16	27
WSW	20	8	22
W	6	9	17
WNW	3	4	15
NW	2	8	7
NNW	3	3	5

Source: ERT 1977.

Air quality data collected in southwestern Wyoming during 1975 were used to establish baseline conditions. These TSP data for 1975 were statistically compared to 1976 TSP data for each of several state and private monitoring sites to determine any significant differences in TSP concentrations between the two years. Results indicate a significant difference in only four sites, all of which are explained by the movement of the monitor or increased activity in the area. Thus, it was concluded that in general the regional air quality measured by the monitors did not change significantly from one year to the next. Therefore, 1975 TSP data were assumed to be representative of the area and were used as a basis for the modeling study. Detailed discussion of the 1975-1976 data comparison can be found in the Chapter 2, Regional Technical Report (Environmental Research and Technology (ERT) 1978a), on file at the Rock Springs District Office of the BLM.

Air Quality Standards and Regulations

On 30 April 1971, the EPA promulgated primary and secondary NAAQS *(Federal Register* 1971). The primary standards were established to protect human health; whereas, the secondary standards were established to protect the public welfare from any known or anticipated adverse effects. The primary and secondary 24-hour or short-term standards for TSP, not to be exceeded more than once per year, are 260 and 150 micrograms per cubic meter ($\mu g/m^3$), respectively. The annual or long-term limits are 75 and 60 $\mu g/m^3$. These are, respectively, the primary standard and a guideline rather than a secondary standard. An annual TSP concentration is defined as a geometric mean. The NAAQS for SO_2 are 1,300 $\mu g/m^3$, 365 $\mu g/m^3$, and 80 $\mu g/m^3$ for the 3-hour maximum, 24-hour maximum, and annual arithmetic mean, respectively. The 3-hour maximum is a secondary standard; the other two are primary standards. The short-term standards are not to be exceeded more than once per year. The annual limit established for NO_2 is 100 $\mu g/m^3$. The Clean Air Act Amendments of 1977 charged EPA with promulgating a 3-hour (or less) primary standard for NO_2 unless there is "no significant evidence"that such a standard is needed to protect public health.

On 22 January 1972, the State of Wyoming adopted air quality regulations that differed slightly from NAAQS. The state annual standard for TSP is 60 $\mu g/m^3$ (geometric mean) and the 24-hour standard, not to be exceeded more than once per year, is 150 $\mu g/m^3$. The annual SO_2 standard is 60 $\mu g/m^3$ (arithmetic mean) and the 24-hour standard, not to be exceeded more than once a year, is 260 $\mu g/m^3$. The state limit for NO_2 is the same as the NAAQS for NO_2. Table R2-2A summarizes the State of Wyoming and federal ambient air quality standards for these pollutants.

In January 1972, the State of Wyoming classified the Wyoming Intrastate AQCR as Priority III for TSP, meaning that ambient air quality within this region was better than the state standards. On 7 December 1977, the State of Wyoming submitted its initial list of two nonattainment areas in the southwestern Wyoming ES region: the city of Rock Springs and the trona mining area, 6 miles north of Green River (personal communication, C. Raffelson, Wyoming Department of Environmental Quality, 5 January 1978 (ERT 1978a)). The EPA has modified the list to include only the trona mining area (personal communication, W. Russell, Wyoming Department of Environmental Quality, January 1978 (ERT 1978a)).

Table R2-2B lists the existing TSP and SO_2 regulations for Prevention of Significant Deterioration (PSD). These levels, designated for Class I, II, and III areas, are set to regulate incremental increases of TSP and SO_2 from new sources within Priority III regions according to the amount of energy or industrial growth desired. The allowable PSD air quality increments represent the maximum increase in pollutant concentrations allowable over and above existing baseline ambient levels. For all PSD classes, air quality deterioration would be permitted as long as neither the applicable PSD air increment nor the secondary NAAQS is exceeded. The following classes of desired growth were established by the EPA:

Class I—areas where nearly any air quality deterioration would be considered significant, thus allowing little or no energy or industrial development.

Class II—areas where deterioration that would normally accompany moderate, well-controlled growth would not be considered significant.

Class III—areas where deterioration would be permitted to allow concentrated or very large scale energy or industrial development as long as the secondary NAAQS are not exceeded.

The State of Wyoming was initially classified a Class II area with the exception of five wilderness areas and two national parks larger than 6,000 acres, which have been classified mandatory Class I. Of these seven Class I areas, only Bridger Wilderness Area is located in southwestern Wyoming (Map R2-2A). In addition to the existing Class I area, two proposed wilderness areas near the ES region could gain Class I status in the near future: Popoagie and Flaming Gorge National Recreation Area in Wyoming and High Uinta Primitive Area in Utah (personal communication, T. Connor, U.S. Forest Service, Bridger National Forest, Wyoming, 12 January 1978 (ERT 1978a)). At present, neither the State of Wyoming nor the Wind River Indian Reservation has definite plans to reclassify any other areas of the state (personal communciation, C. Raffelson, Wyoming Department of Environmental Quality, 5 January 1978).

Existing Ambient Air Quality

For the purpose of describing air quality, the ES region has been divided into three portions as follows:

Western—this portion is bounded on the east by the Bridger Basin and on the north/south line through Lyman, Wyoming. The monitoring data collected in this

Table R2-2A

STATE OF WYOMING AND NATIONAL AMBIENT AIR QUALITY STANDARDS FOR CONCENTRATIONS OF TSP, SO_2, AND NO_2

Pollutant	Averaging Time	Standard ($\mu g/m^3$) Federal Primary[1]	Federal Secondary[2]	Wyoming
TSP	Annual[3]	75	60[4]	60
	24-Hour[5]	260	150	150
SO_2	Annual[6]	80		60
	24-Hour[5]	365		260
	3-Hour[5]		1,300	1,300
NO_2	Annual[6]	100	100	100

Source: ERT 1978a.

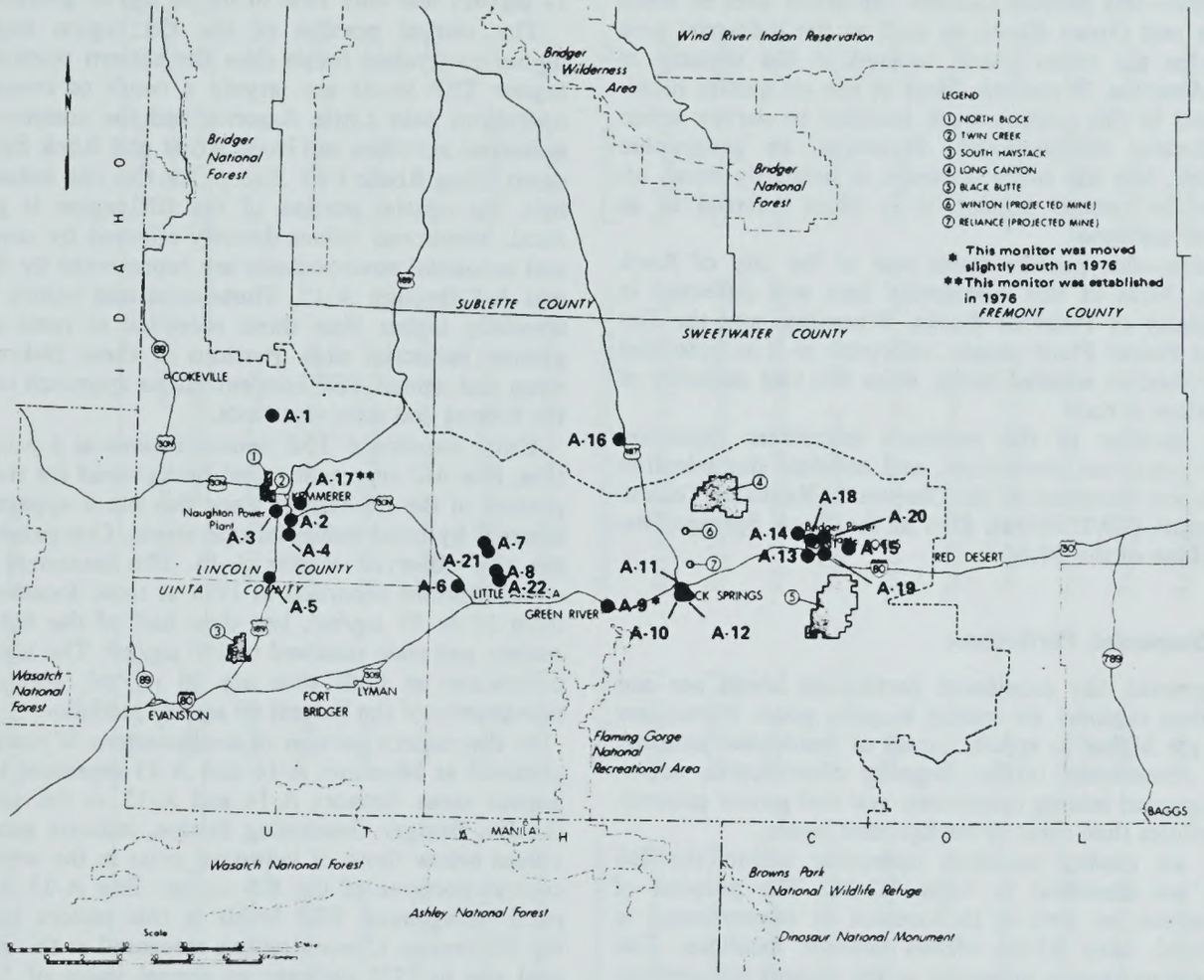
[1]Requisite to protect human health.
[2]Requisite to protect the public welfare from any known or anticipated adverse effects.
[3]Geometric mean.
[4]Guideline.
[5]Not to be exceeded more than once per year.
[6]Arithmetic mean.

Table R2-2B

ALLOWABLE AIR QUALITY INCREMENTS UNDER
PREVENTION OF SIGNIFICANT DETERIORATION RESTRICTIONS (ug/m^3)

EPA Pollutant Standard	Class I	Class II	Class III
TSP			
Annual	5	19	37
24-hour	10	37	75
SO_2			
Annual	2	20	40
24-hour	8	91	182
3-hour	25	512	700

Source: Clean Air Act Amendments (1977).



MAP R2-2A

LOCATION OF AIR QUALITY MONITORS SOUTHWESTERN WYOMING IN 1975

Source: ERT 1978a.

western portion is descriptive of Kemmerer and its surroundings (see Map R2-2A).

Central—this portion includes the urban sites of Rock Springs and Green River, as well as the industrial area known as the trona patch, located in the vicinity of Little America, Wyoming. Most of the air quality monitors used in this portion were installed to survey urban or industrial environments. However, its geographic character, like the other portions, is primarily rural, although the central portion is at times referred to as urban or industrial.

Eastern—this portion starts east of the city of Rock Springs. Most of this monitoring data was collected in the vicinity of Point of Rocks, Wyoming, and the Jim Bridger Power Plant. Again, reference to it as industrial is only used in relative terms, since the vast majority of the portion is rural.

The location of the monitors instrument exposure, quality assurance procedures, and monitor site selection criteria are discussed in the Chapter 2, Regional Technical Report (ERT 1978a), filed at the Rock Springs District Office of the BLM.

Total Suspended Particulates

In general, the monitored particulate levels are not high; thus regional air quality is quite good. Particulate levels are higher in specific areas of residential housing, heavy commercial traffic, ongoing construction, active above-ground mining operations, and (or) power generating facilities than rural or background levels.

The air quality monitors operating within the ES region are identified in Table R2-2C. The purpose of each sensor, as well as its location or environment, is also listed. Map R2-2A shows monitor locations. The peak concentrations measured at the sensors are summarized in Table R2-2D. Maps R2-2B and R2-2C illustrate the spatial distribution of these data for the analysis year 1975.

The western portion of the ES region includes industrial as well as rural areas. The TSP levels in this portion are quantified by data obtained at monitors A-1, A-2, A-3, A-4, and A-5. Particulate levels measured in the vicinity of Kemmerer, the only industrialized area in this subregion, indicate that this is the area of heaviest particulate impact. The samples obtained at monitors A-2, A-3, and A-4 represent background TSP levels in an industrialized environment, as these sensor locations were established to monitor the impact from existing coking, mining, and power generating facilities (personal communication, W. Ursenbach, University of Utah, 16 December 1976 (ERT 1978a)). The maximum 24-hour TSP concentrations measured at these sites in 1975 range from 103 $\mu g/m^3$ (69% of the federal secondary standard and the state standard) to 69 $\mu g/m^3$ (less than half of these standards). The peak annual concentration (geometric mean) of 24 $\mu g/m^3$ represents 40% of the state and federal limit of 60 $\mu g/m^3$.

In the western portion of the ES region, rural background values are represented by the monitor located at A-1. In 1975, the highest 24-hour sample at monitoring location A-1 was 59 $\mu g/m^3$, only 40% of the federal secondary TSP standard. The peak annual geometric mean, 12 $\mu g/m^3$, was only 20% of the 60 $\mu g/m^3$ guideline.

The central portion of the ES region experiences higher particulate levels than the eastern portion. These higher TSP levels are largely a result of trona mining operations near Little America and the commercial and industrial activities in Green River and Rock Springs located along Route I-80. Except for this one industrialized belt, the central portion of the ES region is generally rural. Monitored values directly affected by commercial and industrial environments are represented by Sites A-6 and A-8 through A-12. These measured values are substantially higher than those recorded at rural or background industrial sites. Portions of these 24-hour maximum and annual TSP concentrations approach or exceed the federal and state standards.

Using monitored TSP concentrations as a prime criterion, Site A-7 represents rural background for the central portion of the ES region, since this site is apparently unaffected by local industrial operations. Comparable levels are also observed at Site A-16. The maximum 24-hour concentrations recorded in 1975 at these locations range from 53 to 63 $\mu g/m^3$, less than half of the federal secondary and state standard of 150 $\mu g/m^3$. The annual concentrations at both sites are 16 $\mu g/m^3$, approximately one-quarter of the federal 60 $\mu g/m^3$ guideline.

In the eastern portion of southwestern Wyoming, data obtained at Monitors A-14 and A-15 represent industrial impact areas. Sensors A-14 and A-15, in the vicinity of the Jim Bridger Generating Station, indicate annual TSP values below those of industrial areas in the western and central portions of the ES region. Site A-13 represents rural background TSP levels in this eastern portion of the ES region. Concentrations measured at this nonindustrial site in 1975 indicate an annual value of 13 $\mu g/m^3$ and a maximum 24-hour value of 43 $\mu g/m^3$. All rural areas in the eastern portion of the ES region are expected to experience TSP levels similar to Site A-13.

Sulfur Dioxide

The twelve SO_2 monitors selected to represent the general air quality in the western, central, and eastern portions of the ES region are shown in Table R2-2C. The purpose of each sensor, as well as its environment is also listed. Table R2-2E presents, where available, the highest and second highest 3- and 24-hour average SO_2 concentrations, as well as annual averages for each of the sites. As indicated, recorded 3-hour, 24-hour, and annual SO_2 concentrations in southwestern Wyoming do not exceed federal or Wyoming ambient air quality standards in any instance.

In the western portion of the ES region, the maximum 24-hour SO_2 concentrations measured in 1975 to 1976 ranged from 14 $\mu g/m^3$ (4% of the federal and 5% of the state standard) to 26 $\mu g/m^3$ (7% of the federal and 10% of the state standard). Similarly, the 3-hour peaks are less than 10% of the state and federal standards of 1,300 $\mu g/m^3$. The peak annual concentration (arithmetic mean) of

Table R2-2C

AIR QUALITY MONITORS IN SOUTHWESTERN WYOMING

Site Code	Monitor	Location	County	Portion of Region	Monitoring Purpose/ Environment	Private or State Operation	Pollutants Monitored at Site
A-1	Naughton, K-4	Kemmerer	Lincoln	West	Background/rural	Private	TSP
A-2	Naughton, K-3	Kemmerer	Lincoln	West	Impact/industrial	Private	TSP, SO_2
A-3	Naughton, K-2	Kemmerer	Lincoln	West	Impact/industrial	Private	TSP, SO_2
A-4	Naughton, K-1	Kemmerer	Lincoln	West	Impact/industrial	Private	TSP, SO_2
A-5	South Haystack		Lincoln	West	Background/rural	Private	TSP
A-6	Don Lindsley[1]	Granger	Sweetwater	Central	Background/residential	State	TSP
A-7	Texas Gulf No. 1	Little America	Sweetwater	Central	Background/industrial	Private	TSP
A-8	FMC--Site A	Little America	Sweetwater	Central	Background/industrial	Private	TSP
A-9[2]	Larry Clause[1]	Green River	Sweetwater	Central	Background/residential	State	TSP
A-10	John Logan[1]	Rock Springs	Sweetwater	East	Background/residential	State	TSP
A-11	Lyman Fearn[1]	Rock Springs	Sweetwater	East	Impact/center city	State	TSP, SO_2
A-12	Robert Alder[1]	Rock Springs	Sweetwater	East	Background/residential	State	TSP
A-13	Black Butte		Sweetwater	East	Background/rural	Private	TSP
A-14	Bridger-Superior Wells	Point of Rocks	Sweetwater	East	Impact/industrial	Private	TSP, SO_2,NO_2
A-15	Bridger-Microwave	Point of Rocks	Sweetwater	East	Impact/industrial	Private	TSP, SO_2,NO_2
A-16	Sellers[1]	Eden	Sweetwater	North	Background/rural	State	TSP
A-17[3]	Kemmerer	Kemmerer	Lincoln	West	Background/rural	State	TSP, SO_2,NO_2

Table R2-2C

AIR QUALITY MONITORS IN SOUTHWESTERN WYOMING
(Continued)

Site Code	Monitor	Location	County	Portion of Region	Monitoring Purpose/ Environment	Private or State Operation	Pollutants Monitored at Site
A-18	Bridger-Plant	Point of Rocks	Sweetwater	East	Impact/industrial	Private	TSP, SO_2,NO_2
A-19	Bridger-Point of Rocks	Point of Rocks	Sweetwater	East	Impact/industrial	Private	TSP, SO_2,NO_2
A-20	Bridger-Bluff Station	Point of Rocks	Sweetwater	East	Impact/industrial	Private	TSP, SO_2,NO_2
A-21[3]	FMC--Site C	Little America	Sweetwater	Central	Impact/industrial	Private	SO_2
A-22[3]	Texas Gulf--Site 4	Little America	Sweetwater	Central	Background/industrial	Private	SO_2

Source: ERT 1978a.

[1]Private residences.
[2]Monitor A-9 was moved slightly south in 1976.
[3]Monitors established in 1976.

Table R2-2D

PARTICULATE CONCENTRATIONS MEASURED IN SOUTHWESTERN WYOMING
($\mu g/m^3$)

Site Code	Sampling Year	Number of Observations[1]	Maximum 24-Hour Concentration	2nd Highest 24-Hour Concentration	Number of Violations of the Federal 24-Hour Standards		Annual Geometric Mean
					Primary	Secondary	
A-1	1973	32	114	92	0	0	16
	1974	23	47	NA	0	0	22
	1975	22	59	44	0	0	12
	1976	27	51	47	0	0	15
A-2	1973	16	46	42	0	0	21
	1974	41	71	NA	0	0	34
	1975	45	103	86	0	0	21
	1976	30	74	71	0	0	18
A-3	1973	14	50	35	0	0	22
	1974	31	91	NA	0	0	39
	1975	40	83	77	0	0	20
	1976	32	75	61	0	0	26
A-4	1973	23	65	48	0	0	24
	1974	37	125	NA	0	0	53
	1975	46	69	58	0	0	24
	1976	33	78	77	0	0	34
A-5	1976	27[1]	68	64	0	0	28
A-6	1973	46	114	109	0	0	43
	1974	53	209	195	0	2	54
	1975	57	93	87	0	0	27
	1976	57	150	101	0	0	39
A-7	1974	49	59	43	0	0	21
	1975	60	53	45	0	0	16
	1976	59	57	53	0	0	19
A-8	1974	34	126	91	0	0	35
	1975	92	143	99	0	0	28
	1976	37	73	70	0	0	27
A-9	1975	49	119	115	0	0	46[3]
	1976	58	84	80	0	0	37[3]
A-10	1975	59	131	111	0	0	40
	1976	58	259	218	0	2	58
A-11	1972	45	271	240	0	1	119
	1973	50	321	277	3	20	118
	1974	52	347	308	7	18	115
	1975	57	231	207	0	11	90
	1976	58	248	218	0	9	100

Table R2-2D

PARTICULATE CONCENTRATIONS MEASURED IN SOUTHWESTERN WYOMING
($\mu g/m^3$)

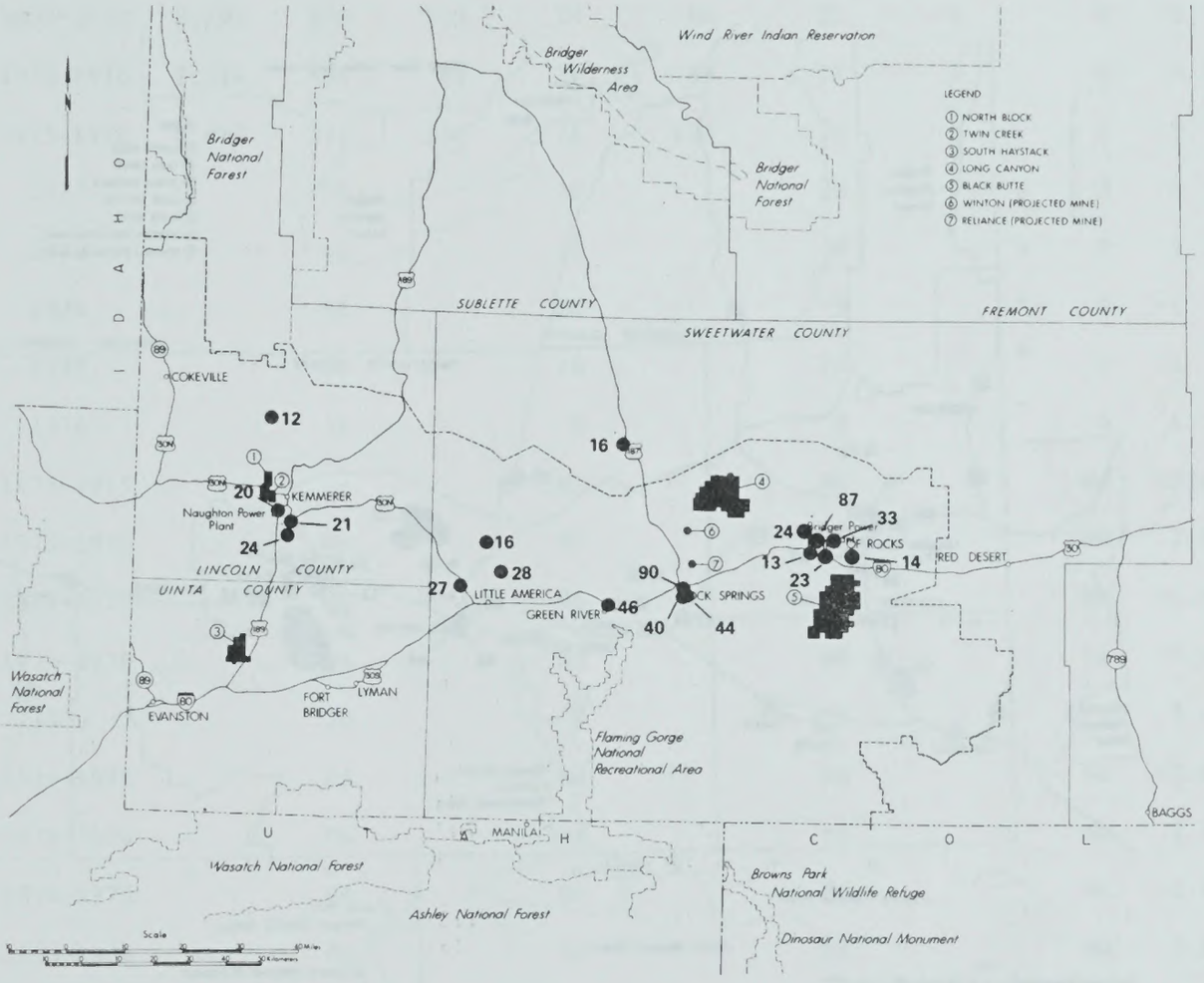
Site Code	Sampling Year	Number of Observations[1]	Maximum 24-Hour Concentration	2nd Highest 24-Hour Concentration	Number of Violations of the Federal 24-Hour Standards		Annual Geometric Mean
					Primary	Secondary	
A-12	1975	46	283	155	0	1	44
	1976	54	145	145	0	0	38
A-13	1975	34	43	26	0	0	13
	1976	60	37	33	0	0	13
A-14	1971-1972	NA	NA	NA	NA	NA	23
	1972-1973	NA	NA	NA	NA	NA	21
	1973-1974	NA	NA	NA	NA	NA	20
	1974-1975	71	167	162	0	1	24
	1975-1976	60	100	87	0	0	32
A-15	1971-1972	NA	NA	NA	NA	NA	31
	1972-1973	NA	NA	NA	NA	NA	22
	1973-1974	NA	NA	NA	NA	NA	14
	1974-1975	69	64	57	0	0	14
	1975-1976	55	95	91	0	0	19
A-16	1975	28	63	39	0	0	16
	1976	52	94	50	0	0	19
A-17	1976	15	45	30	0	0	13
A-18	1971-1972	NA	NA	NA	NA	NA	53
	1972-1973	NA	NA	NA	NA	NA	61
	1973-1974	NA	NA	NA	NA	NA	80
	1974-1975	67	805	787	5	13	87
	1975-1976	56	1135	526	9	16	56
A-19	1974-1975	41	121	112	0	0	23
	1975-1976	54	59	48	0	0	25
A-20	1974-1975	15	76	47	0	0	33
	1975-1976	55	303	113	0	1	32

Source: ERT 1978a.

Note: See Table R2-2C and Map R2-2A for descriptions of monitor locations and environments.

[1]Samples were obtained approximately every 6 days.
[2]See Table R2-2A.
[3]Average of four quarterly geometric means.

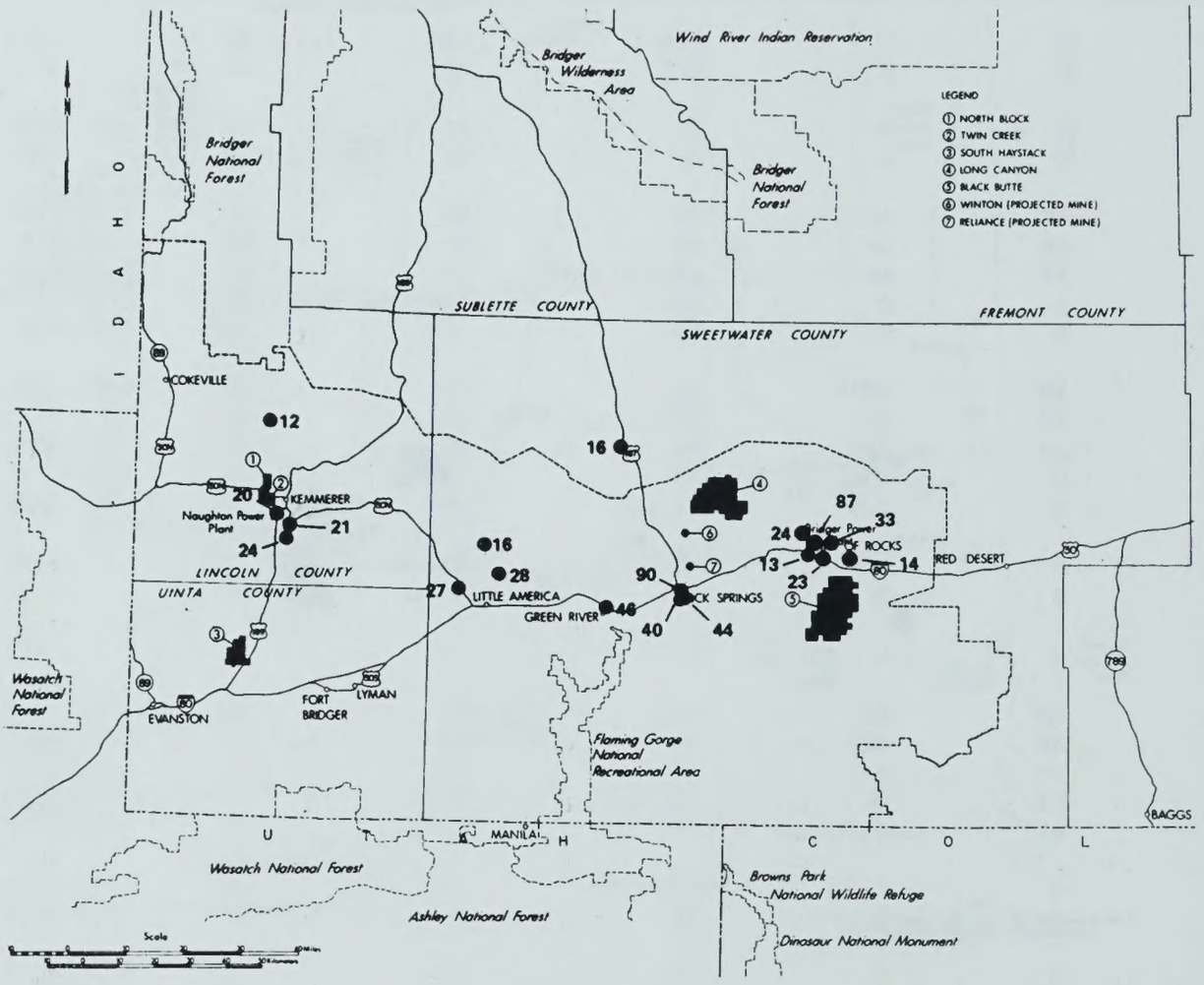
NA = Not Available



Map R2-2B

1975 ANNUAL GEOMETRIC MEAN TSP CONCENTRATIONS MONITORED IN SOUTHWESTERN WYOMING

Source: ERT 1978a.



Map R2-2C

1975 MAXIMUM 24-HOUR TSP CONCENTRATIONS MONITORED IN SOUTHWESTERN WYOMING

Source: ERT 1978a.

Table R2-2E

CONCENTRATIONS OF SO_2 MEASURED IN SOUTHWESTERN WYOMING
($\mu g/m^3$)

Site	Sampling Year	Number Observations 1-Hour	Number Observations Daily	Maximum Concentration 3-Hour	Maximum Concentration 24-Hour	2nd Highest Concentration 3-Hour	2nd Highest Concentration 24-Hour	No. Violations of the Federal Standard 3-Hour	No. Violations of the Federal Standard 24-Hour	Arithmetic Mean
A-2	1975-1976	8,491	350	115	24	86	21	0	0	2
A-3	1975-1976	7,514	304	89	14	89	11	0	0	0.7
A-4	1975-1976	8,056	331	105	26	100	22	0	0	3
A-11[1]	1972		29		20		20		0	4
	1973		42		12		8		0	3
	1974		46		10		5		0	1
	1975		59		10		10		0	2
	1976		36		9		8		0	1
A-14[2]	1974-1975		-		NA		NA		NA	<2.6 (9 mos.)[3]
	1975-1976		NA		NA		NA		NA	2.6
A-15[2]	1974-1975		NA		NA		NA		NA	<2.6 (9 mos.)
	1975-1976		NA		NA		NA		NA	2.6
A-17[1]	1976		10		5		2		0	1
A-18	1974-1975		NA		NA		NA		NA	<2.6 (9 mos.)
	1975-1976		NA		NA		NA		NA	2.6
A-19[2]	1974-1975		NA		NA		NA		NA	<2.6 (6 mos.)
	1975-1976		NA		NA		NA		NA	2.6
A-20[2]	1974-1975		NA		NA		NA		NA	5.2 (3 mos.)
	1975-1976		NA		158		117		0	10.4
A-21	1974	226	-	309	131		128	0	0	NA
	1975	6,704	-	197	98		77	0	0	NA
	1976	5,102	-	197	99		62	0	0	NA
A-22	1976		9		3		3		0	NA

Source: ERT 1978a.

[1] SO_2 gas bubbler providing 24-hour average alone.
[2] Short-term data not readily available.
[3] Sampling duration.

NA = Not Available.

3 $\mu g/m^3$ represents 4% and 5% of the federal and state standards, respectively.

Monitors for SO_2 in the central portion of the ES region are situated near Little America in the basin referred to as the trona patch. Monitor A-22 is located slightly northeast of Little America on an isolated mesa southeast of the Texas Gulf Plant. Data collected at this sensor should represent the general background levels of this industrial area and not the direct plant emissions. Only nine observations were made at this station in 1976, giving insufficient data from which to draw conclusions. However, preliminary data from A-22 suggests that background SO_2 levels in the area should be safely below short-term standards, with peak values at or below the resolution of the instrument.

Northwest of monitor A-22 is the FMC monitor A-21. This sensor is positioned 3,000 feet to the east of the FMC plant, and data collected at this site should represent the direct impact from the facility. The maximum 24-hour SO_2 concentration recorded in 1976 is 99 $\mu g/m^3$, 38% of the 260 $\mu g/m^3$ state standard.

Another state SO_2 bubbler (A-11) is located in the city of Rock Springs. It was installed to survey ambient SO_2 levels in this central Wyoming population district. The peak 24-hour concentration recorded at this site was 20 $\mu g/m^3$ in 1972. The annual mean in that year was 4 $\mu g/m^3$, only 7% of the corresponding state standard.

The SO_2 monitors in the eastern portion of the ES region are located in the vicinity of the Jim Bridger Power Plant. These samplers collect data on plant emissions. Unit A-20, Bluff Station, is situated directly downwind (east) of the Jim Bridger Plant; thus, it records the greatest levels of SO_2 in the Bridger network. The maximum 24-hour concentration measured in 1976 at A-20 is 158 $\mu g/m^3$ (43% and 61% of federal and state standards, respectively). The peak annual concentration (arithmetic mean) is 10.4 $\mu g/m^3$ (13% of federal and 17% of Wyoming standards). Annual average concentrations at A-14, A-15, A-18, and A-19 were at or below 2.6 $\mu g/m^3$.

In summary, ambient SO_2 levels are generally very low throughout the ES region. On occasion, at certain locations, short-term SO_2 concentrations can peak in association with plume passage emanating from an isolated point source. However, the available data suggest that these higher, short-term SO_2 levels are local, within ambient standards, and atypical of the ES region as a whole. Annual SO_2 concentrations appear to range from only 5% to 15% of the state and federal standards.

Nitrogen Dioxide

A very limited amount of NO_2 data are available for the ES region because of the small number of monitoring sites in the area. Table R2-2F summarizes the available data. Station A-17 represents rural background concentrations of NO_2 on the outskirts of the town of Kemmerer. The maximum 24-hour concentration is reported as 14 $\mu g/m^3$, and the annual arithmetic mean is reported as 7 $\mu g/m^3$, only 7% of the federal and state primary standard of 100 $\mu g/m^3$.

The other five monitoring stations represent industrial background NO_2 levels and range from 2 to 24 $\mu g/m^3$. Monitor A-20 was installed directly downwind of the Jim Bridger Power Plant to measure impact of the plant's emissions. Measurement of NO_2 at the plant site (A-18) and Point of Rocks site (A-19) are thought to be closely related to local and highway traffic patterns, respectively. Diurnal peaks at these latter sites are coincident with increased early morning traffic levels and cold stable air at the surface (Crow and Hadley 1975). However, no violations of the federal NO_2 annual standard were found in the ES region.

Visibility

The data sets used for estimating background visibility consisted of 5 years of hourly visual observations taken at both the Fort Bridger and Rock Springs Airports (1950 to 1954 and 1960 to 1964, respectively).

Horizontal Visibility from Airport Observations. Visual observations of physical objects at known distances are made and recorded. These data sets document discrete ranges in horizontal visibility from zero (< 1/16 mile) to greater than 100 miles (unlimited). Obscurations to horizontal visibility (such as fog, haze, smoke, or blowing dust) are mandatorily recorded only if visibility is limited to less than 7 statute miles during a given hourly period. Table R2-2G presents the number of hours and percent frequency of occurrence of horizontal visibility observations in seven distance ranges for both the Fort Bridger and Rock Springs Airports. As indicated, Fort Bridger and Rock Springs had a total of 21,932 and 21,989 hours of visibility observations during the daylight hours of their respective 5-year records.

Prominent topographic features at a distance of 41 to 50 miles from both the Fort Bridger and Rock Springs Airports appear to be easily referenced in visual observations, since about 57% and 67%, respectively, of all daytime observations were tabulated in that range at each site. Otherwise, visual range was evenly distributed between 11 and 40 miles at Fort Bridger. However, a secondary peak in the frequency of visual observations between 11 and 20 miles was observed at the Rock Springs site. This secondary peak in visual range likely results from another prominent landmark in the airport observer's line of sight, instead of a discontinuity caused by a real optical phenomenon.

There were no observations of blowing dust or sand that restricted visibility to less than 7 miles at either Fort Bridger or Rock Springs during their respective 5-year recording periods. The visibility was restricted by smoke and (or) haze during only 6 and 4 hours at Fort Bridger and Rock Springs, respectively. In addition, both fog and blowing snow significantly reduced visibility during less than 1% each of the total daylight hours at the two airports. Rain and snow, although occurring relatively infrequently, appear to be the mechanisms that limit horizontal visibility most frequently in the ES region.

In summary, visual range in the ES region is good. The coincidence of the model differential frequencies at the two airport sites is not significant, but that more than

Table R2-2F

CONCENTRATIONS OF NO_2 IN SOUTHWESTERN WYOMING
($\mu g/m^3$)

Site	Sampling Year	Number Observations	Maximum 24-Hour Concentration	2nd Highest 24-Hour Concentration	No. Violations of Federal Annual Std.	Annual Arithmetic Mean
A-17	1976	9	14	12	0	7
A-14	1974-1975	NA	NA	NA	0	<2
	1975-1976	NA	NA	NA	0	2
A-15	1974-1975	NA	NA	NA	0	<2
	1975-1976	NA	NA	NA	0	2
A-18	1974-1975	NA	NA	NA	0	4
	1975-1976	NA	NA	NA	0	4
A-19	1974-1975	NA	NA	NA	0	14
	1975-1976	NA	NA	NA	0	24
A-20	1974-1975	NA	NA	NA	0	4
	1975-1976	NA	NA	NA	0	4

Source: ERT 1978a.

NA = Not Available

Table R2-2G

5-YEAR SUMMARY OF HORIZONTAL VISIBILITY IN ES REGION

Horizontal Visibility (miles)	Fort Bridger			Rock Springs		
	Number of Daylight Observations	Differential Frequency (%)	Cumulative Frequency (%)	Number of Daylight Observations	Differential Frequency (%)	Cumulative Frequency (%)
<50	451	2.06	2.06	56	0.26	0.26
41-50	12,490	56.95	59.01	14,639	66.57	66.83
31-40	3,079	14.04	73.05	45	0.20	67.03
21-30	2,828	12.89	85.94	336	1.53	68.56
11-20	1,700	7.75	93.69	5,495	24.99	93.55
6-10	639	2.91	96.60	623	2.83	96.38
<5	745	3.40	100.00	795	3.62	100.00
Total	21,932	100.00	100.00	21,989	100.00	100.00

Source: ERT 1978a.

one-half of all visual observations at each site exceed 40 miles suggests that it would be a minimum distance reasonable for the definition of a background visual range in southwestern Wyoming.

GEOLOGY

Stratigraphy

Names, ages, and lithologies of formations in the eastern part of the southwestern Wyoming region, shown on Figure R2-3A, differ from those in the western part of the area, shown on Figure R2-3B. Much of the nomenclature is used consistently in both areas, but occasionally different names are applied to the same rock unit, or a unit may be entirely missing in one of the areas.

The stratigraphic succession in the southwestern Wyoming region ranges in age from Cambrian to Tertiary and has a cumulative thickness of nearly 19,000 feet (Map 4A, Appendix A). Coal-bearing formations are shown on Figures R2-3A and R2-3B.

Paleontology

To date, only a limited number of paleontological surveys have been conducted in the region, with the majority of attention being given to fossil vertebrates. A general summary of the principal fossiliferous formations, ages, number of known fossil localities, and general fossil types in proposed project areas of the ES region is presented in Table R2-3A.

Structure

The principal structural features in the region are the Overthrust Belt, the Green River Basin, the Rock Springs Uplift, the Great Divide Basin, and the Washakie Basin (Figure R2-3C). The structure of the Green River Basin, the Great Divide Basin, and the Washakie Basin has no bearing on the proposed projects and will not be discussed.

The structural pattern of the Overthrust Belt, located in the western part of the area, is that of large, compressed, partly overturned folds that are broken into sheets by thrust faults. The direction of thrusting was dominantly eastward. In the Overthrust Belt, the Absaroka Thrust and the Darby Thrust are major faults; the Meridian Anticline and Lazeart Syncline are major folds. Fossil Syncline is a shallow structural depression composed of Tertiary rocks that overlie more deformed Cretaceous and older rocks (Map 4B, Appendix A).

The Rock Springs Uplift, located east of the Green River Basin, is a doubly plunging asymmetric anticline. The steep limb is on the west where dips are between 4 degrees and 35 degrees; dips on the east limb are between 5 degrees and 8 degrees. Numerous high-angle normal and reverse faults of early Tertiary age trend generally northeast and dissect the uplift (Maps 4 and 4A, Appendix A). The late Tertiary history of the Rock Springs Uplift includes volcanic activity in the Leucite Hills.

Geologic Hazards

Even though the landslide susceptibility of the rock and earth material is estimated to be high (Radbruch-Hall et al. 1976), the landslide potential of the natural surface in the proposed mining areas is judged to be minimal because the natural slopes show no evidence of earlier sliding. Natural coal outcrops are weathered and have lost their more volatile and more easily ignitable constituents; therefore, the likelihood of coal ignition and combustion in the natural outcrop is low.

The region is in a zone of very low seismic activity; therefore, the probability of damage from earthquakes is low.

TOPOGRAPHY

The southwestern Wyoming region is an area of low mountains and semiarid basins. The total relief is about 3,700 feet, with the highest point (9,778 feet) located in the Wasatch National Forest (T. 12 N., R. 116 W.) and the lowest point (about 6,000 feet) located on Flaming Gorge Reservoir at the southern boundary of the region. The region is located in the Middle Rocky Mountains and is divided geographically from west to east into the Overthrust Belt, Green River Basin, Rock Springs Uplift, Great Divide Basin, and Washakie Basin (see Figure R2-3C). The topography is strongly influenced by folded and faulted sedimentary rocks. The topography of the Green River Basin, the Great Divide Basin, and the Washakie Basin has no bearing on the proposed projects and will not be discussed.

The Overthrust Belt is a series of north-south trending linear folds and faults that form mountains and valleys. Major mountain ranges include the Tunp Range, Sublette Range, and Commissary Ridge. The eastern edge of the Overthrust Belt is roughly delineated by Oyster Ridge, a narrow north-south trending, west-dipping hogback. Oyster Ridge is separated from areas of higher relief to the west by a long valley, several miles in width, called Mammoth Hollow. Situated within linear structures of the Overthrust Belt is a long narrow synclinal basin, Fossil Syncline.

A major drainage divide is present in the Overthrust Belt. The eastern part of the belt is drained by the headwaters of Hams Fork and Blacks Fork which flow eastward and are part of the Colorado River drainage system. The western part of the belt is drained by the Bear River that flows into the Great Salt Lake.

Proposed mining operations in the area of the Overthrust Belt are North Block, South Haystack, and Twin Creek. The South Haystack project area is located at the southern end of Fossil Syncline. The North Block and

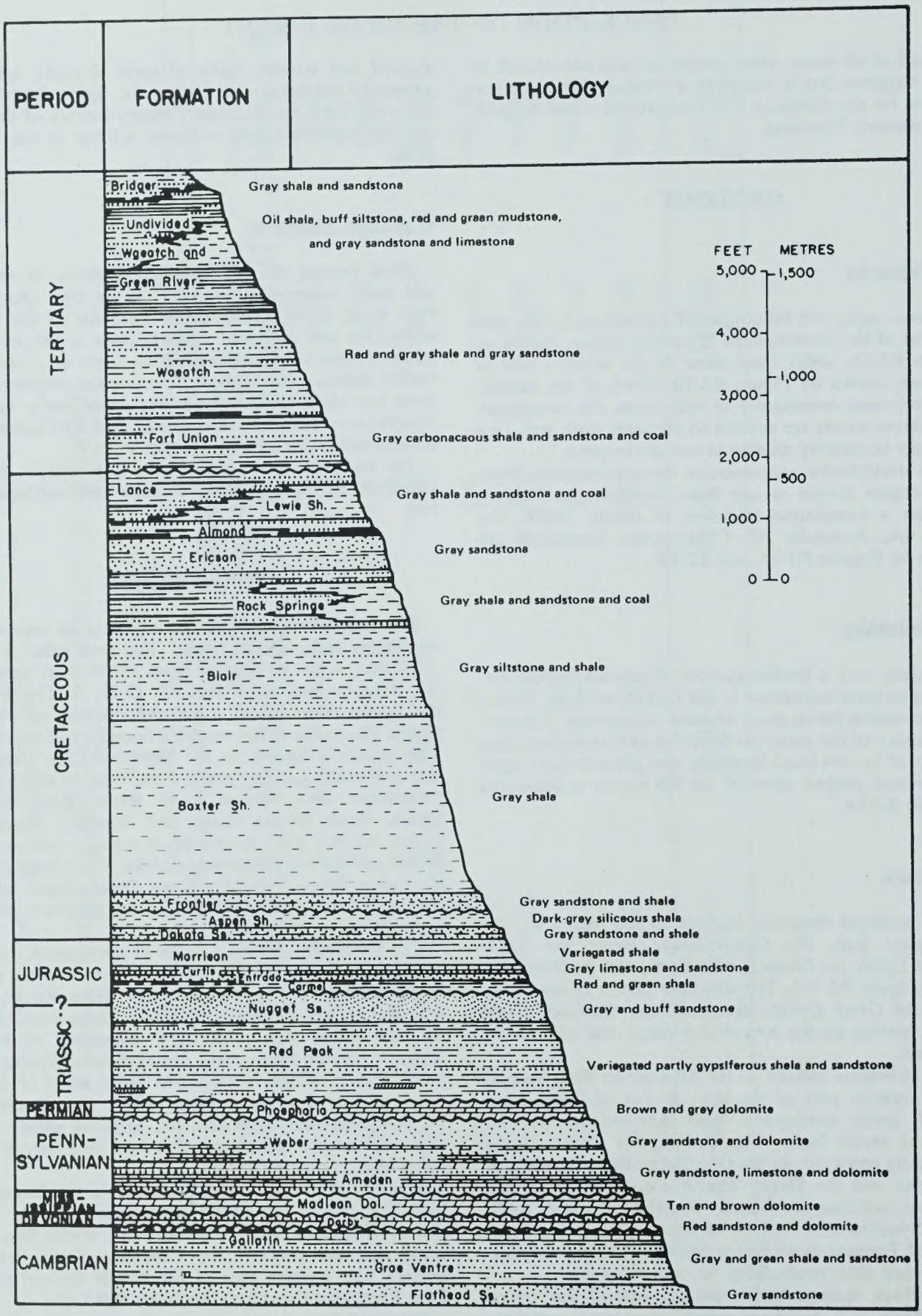


Figure R2 - 3A

SEDIMENTARY SECTION IN THE EASTERN PART OF THE SOUTHWESTERN WYOMING ES REGION

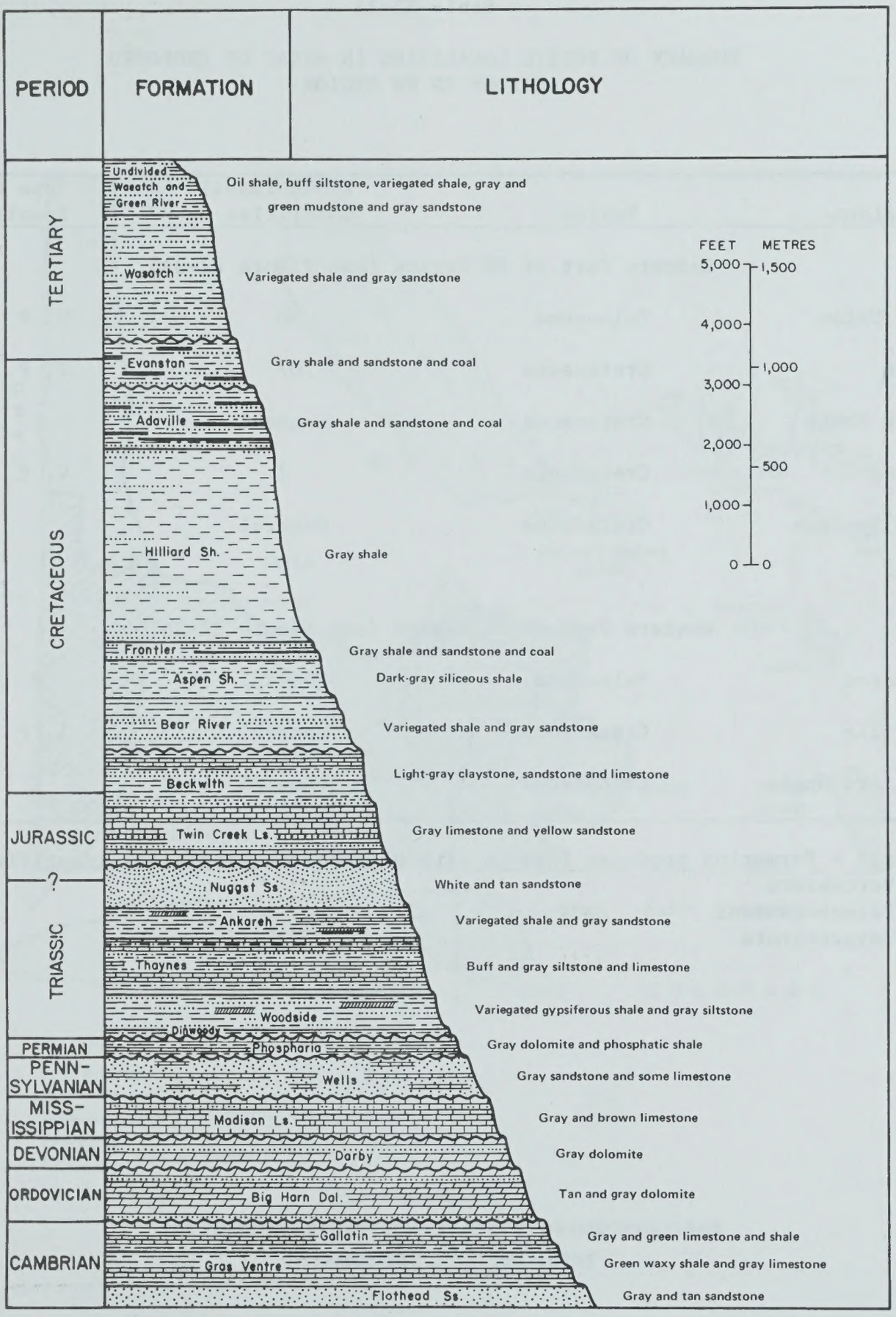


Figure R2 - 3B

SEDIMENTARY SECTION IN THE WESTERN PART OF THE SOUTHWESTERN WYOMING ES REGION

Table R2-3A

SUMMARY OF FOSSIL LOCALITIES IN AREAS OF PROPOSED ACTIONS IN ES REGION

Formation	Period	Known Fossil Localities	Type of Fossils
	Eastern Part of ES Region (see Figure R2-3A)		
Fort Union	Paleocene	30	V, P
Lance	Cretaceous	107	V, P
Lewis Shale	Cretaceous	General	I
Almond	Cretaceous	2	V, P
Rock Springs	Cretaceous	General	I
	Western Part of ES Region (see Figure R2-3B)		
Evanston	Paleocene	General	V
Adaville	Cretaceous	General	I, P
Hilliard Shale	Cretaceous	General	I

General = Formation produces fossils with no specific localities identified.
V = Vertebrate
P = Paleobotanical
I = Invertebrate

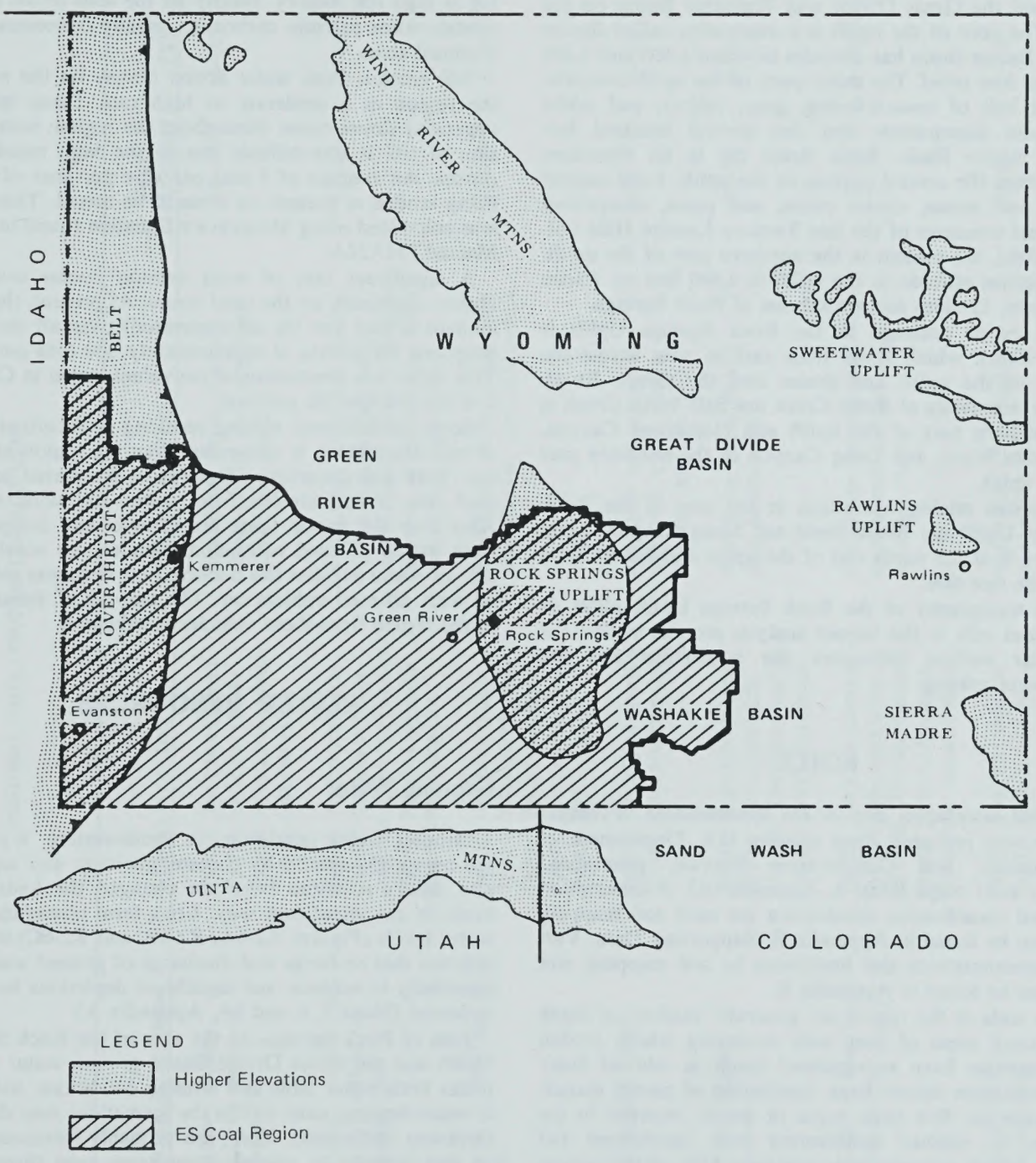


Figure R2 - 3C

THE PRINCIPAL STRUCTURAL FEATURES OF SOUTHWESTERN WYOMING AND ADJACENT AREAS

Twin Creek project areas are located along Mammoth Hollow. The topography of the Overthrust Belt influences the economics and the method of mining.

The Rock Springs Uplift is a deeply eroded structural upwarp lying between the Green River Basin on the west and the Great Divide and Washakie Basins on the east. The core of the uplift is a depression called Baxter Basin. Baxter Basin has altitudes between 6,300 and 6,800 feet and low relief. The outer parts of the uplift comprise a wide belt of inward-facing, gray, yellow, and white sandstone escarpments that rise several hundred feet above Baxter Basin. Rock strata dip in all directions away from the central portion of the uplift. Lava-capped buttes and mesas, cinder cones, and pipes, comprising erosional remnants of the late Tertiary Leucite Hills volcanic field, are present in the northern part of the uplift. The highest altitude in the uplift is 8,680 feet on Aspen Mountain, 12 miles south-southeast of Rock Springs.

The major drainage in the Rock Springs Uplift is Bitter Creek which flows from east to west across the center of the uplift and drains into the Green River. Larger tributaries of Bitter Creek are Salt Wells Creek in the southern part of the uplift and Horsethief Canyon, Deadman Wash, and Long Canyon in the northern part of the uplift.

Proposed mining operations in the area of the Rock Springs Uplift are Black Butte and Long Canyon. Long Canyon is at the north end of the uplift and Black Butte is on the east side.

The topography of the Rock Springs Uplift plays an important role in the impact analysis process in that the irregular surface influences the economics and the method of mining.

SOILS

A soil association map of the southwestern Wyoming region was prepared from existing U.S. Department of Agriculture, Soil Conservation Service, generalized county soils maps (Map 5, Appendix A). A description and soil classification breakdown for each soil mapping unit can be found in Appendix B, Supporting Data. Various interpretations and limitations by soil mapping unit can also be found in Appendix B.

The soils of the region are generally shallow in depth with small areas of deep soils occurring where eroded soil particles have accumulated (such as alluvial fans). Soil formation occurs from weathering of parent material. There are five basic types of parent material in the region: (1) residual sedimentary rock (sandstones and shale), which occupies approximately 85% of the region; (2) alluvium (sediments transported and deposited by water), which occupies approximately 13% of the region; (3) aeolian (wind deposited sands), which occupies approximately 1% of the region; (4) residual volcanic deposits (pumice and wyomingite), which occupies less than 1% of the region; and (5) loess (wind blown silt deposits), which occupies less than 1% of the region (Table R2-5A).

Soil structure of the region's soils is generally weak in stability to nonexistent. The soils range from nonalkaline and saline to strongly alkaline and saline. Nearly all soils in the region have some level of salinity and alkalinity. Alluvial soils along most streams are subirrigated resulting in high soil salinity. Nearly all the soils of the region contain some calcium carbonate, usually concentrated in a subsoil zone.

Soil erosion from water action occurs on the soils of the region at a moderate to high rate. Steep sparsely vegetated slopes occur throughout the region; water erosion of soil is unavoidable due to the high runoff that occurs. An average of 5 tons per acre per year of soil is being eroded at present on areas to be mined. This value was calculated using Musgrave's Equation found in BLM Manual 7317.22A.

A significant rate of wind erosion occurs over the region, especially on the sand dunes. At present, the total amount of soil lost (in air suspension) over all the areas proposed for mining is approximately 360 tons per year. This value is a summation of the values stated in Chapter 2 of the site-specific analyses.

Some surface coal mining resulting in localized areas of soil disturbance is occurring over the region at present. With soil disturbance there is an associated accelerated rate of soil erosion from water and wind action. Also over the region there are areas of soil compaction from use of off-road recreation vehicles. An accelerated rate of water erosion has occurred on the areas associated with off-road vehicle use. The amount of disturbance in the region from these vehicles is unknown.

WATER RESOURCES

Ground Water

Ground water conditions in southwestern Wyoming are controlled chiefly by climate, geology, and topography. Man's activities have not changed the hydrologic cycle in any significant way. Long-term observations of water levels (Figures R2-6A, R2-6B, and R2-6C) in wells indicate that recharge and discharge of ground water are essentially in balance, and significant depletions have not occurred (Maps 5, 6, and 6A, Appendix A).

East of Rock Springs, in the area of the Rock Springs Uplift and the Great Divide Basin, ground water occurs under both water table and artesian conditions. Individual water-bearing units within the formations may differ in thickness and extent. They are probably interconnected so that indirect or partial connections exist throughout the aquifer system. The principal water-bearing units are of fine- to coarse-grained sandstone, and, where it is sufficiently fractured, a coal seam may be an aquifer. The characteristics of the individual aquifers cover a wide range in thickness, distribution, sorting, grain size, cementation, and clay and silt content. Their water yielding, transmitting, and storing abilities similarly cover a wide range.

Table R2-5A

REGIONAL SOIL PROPERTIES AND USE

Map Reference Number	Mapping Unit Name	Classification	Parent Material	Depth (inches)	Slope (%)	Reclamation Potential[1]
1A	Shallow, loamy, alkaline association	Typic Torriorthents Typic Calciorthids Typic Torripsamments Typic Natrargids	Residium from shale, sandstone, and saline-alkaline shales	10-40	0-30	Fair
1B	Shallow, loamy and clayey, alkaline association	Typic Torriorthents Typic Calciorthids Lithic Torriorthents Typic Torrifluvents Typic Natrargids	Residium from saline-alkaline shales and sandstone; also a small amount of residium from volcanic deposits	10-40	3-40	Fair
1C	Playas - Basins land type	Typic Calciorthids Typic Torriorthents Typic Torripsamments Typic Torrifluvents Typic Natrargids	Residium from sandstone and shale, and alluvium	20-60	0-30	Poor
1D	Sand Dunes land type	Typic Torripsamments Typic Torriorthents	Aeolian deposits derived from sandstones and shales	40+	0-10	Fair
1E	Shallow, loamy association	Typic Torriorthents Typic Calciorthids Lithic Torriorthents Typic Torrifluvents	Residium from shale and sandstone	10-40	6-30	Fair
1F	Shallow - Rockland association	Typic Torriorthents Typic Calciorthids Lithic Torriorthents Typic Torrifluvents Borollic Camborthids	Residium from sandstone and saline marine shale	5-20	6-30	Poor
1G	Fine, saline association	Typic Torriorthents Typic Calciorthids Lithic Torriorthents Borollic Haplargids	Residium from saline marine shales	10-40	3-10	Fair

Table R2-5A

REGIONAL SOIL PROPERTIES AND USE
(Continued)

Map Reference Number	Mapping Unit Name	Classification	Parent Material	Depth (inches)	Slope (%)	Reclamation Potential[1]
2A	Loamy, shallow association	Ustic Torriorthents Borollic Haplargids Borollic Calciorthids Argic Cryoborolls Mollic Cryoboralfs	Residium from sandstone and shale	10-40	0-30	Fair
2B	Shallow, loamy Rockland association	Ustic Torriorthents Borollic Calciorthids Borollic Haplargids	Residium from saline marine shales	5-20	6-30	Poor
2C	Shallow, lithic, loamy association	Typic Cryorthents Typic Cryoborolls Lithic Xeric Torriorthents	Residium from linestone, siltstone, and sandstone	5-20	6-30	Poor
2D	Shallow, loamy - Rock Escarpments association	Ustic Torriorthents Borollic Calciorthids Lithic Torriorthents Typic Torriorthents Typic Calciorthids	Residium from sandstone and saline-alkaline shales	10-30	0-40	Fair
2E	Loamy-Skeletal association	Ustic Torriorthents Borollic Calciorthids Borollic Haplargids Argic Cryoborolls	Gravelly and cobbly alluvium, and residium	20-40	3-10	Fair
2F	Loamy-Skeletal, poorly drained association	Typic Cryoborolls Ustic Fluvaquents Typic Cryoaquents Argic Cryoborolls Typic Cryoaguepts	Cobbly and stony alluvium	40+	3- 6	Fair

Table R2-5A

REGIONAL SOIL PROPERTIES AND USE
(Continued)

Map Reference Number	Mapping Unit Name	Classification	Parent Material	Depth (inches)	Slope (%)	Reclamation Potential[1]
3A	Shallow, loamy - deep gravelly association	Ustic Torriorthents Borollic Calciorthids Typic Cryoborolls Typic Cryoboralfs	Gravelly alluvium and residium from saline-alkaline shales and sandstone	15-60	3-40	Fair
3B	Coarse-loamy - skeletal association	Typic Cryorthents Typic Cryoborolls Argic Cryoborolls	Alluvium and glacial deposits	40+	6-30	Fair
3C	Fine-Loamy - skeletal association	Typic Cryoborolls Argic Cryoborolls Typic Cryoboralfs	Residium, glacial deposits	40+	3-40	Fair
3D	Shallow, loamy - skeletal association	Typic Cryoborolls Argic Cryoborolls Typic Cryoboralfs Typic Cryorthents	Residium from lime-stone, siltstone, and sandstone	10-40	3-40	Fair
4A	Loamy, poorly drained association	Typic Torrifluvents Typic Fluvaquents Typic Halaquepts	Alluvium	40+	0- 6	Good
4B	Coarse-loamy, poorly drained association	Ustic Torrifluvents Typic Fluvaquents Typic Haplaquolls Typic Cryoaquolls Typic Halaquepts	Alluvium	40+	0- 6	Fair
4C	Gravelly terrace soils	Typic Torrifluvents Typic Calciorthids Typic Flavaquents Typic Halaquepts Typic Torripsamments	Alluvium and residium	20+	0-30	Fair

Table R2-5A

REGIONAL SOIL PROPERTIES AND USE
(Continued)

Map Reference Number	Mapping Unit Name	Classification	Parent Material	Depth (inches)	Slope (%)	Reclamation Potential[1]
4D	Fine-loamy, poorly drained association	Typic Cryoaquents Typic Cryoquolls Typic Cryofluvents Borollic Haplargids Calcic Argixerolls Xerollic Calciorthids	Alluvium and loess deposits	40+	3-10	Fair
4E	Loamy and Gravelly, poorly drained association	Typic Calciorthids Typic Torriorthents Typic Torripsamments Typic Fluvaquents Typic Torrifluvents	Alluvium and residium from saline-alkaline shales	20+	0- 6	Fair

[1]Reclamation potential:
Poor--steep slopes, high concentration of salts and (or) carbonates, moderate to strongly alkaline, high erosion potential, shallow soils or combination; reclamation possible.
Fair--between poor and good, has problems in reclamation but not severe.
Good--slopes are level to gently sloping, good levels of organic matter, water availability is good, moderately deep to deep soils.

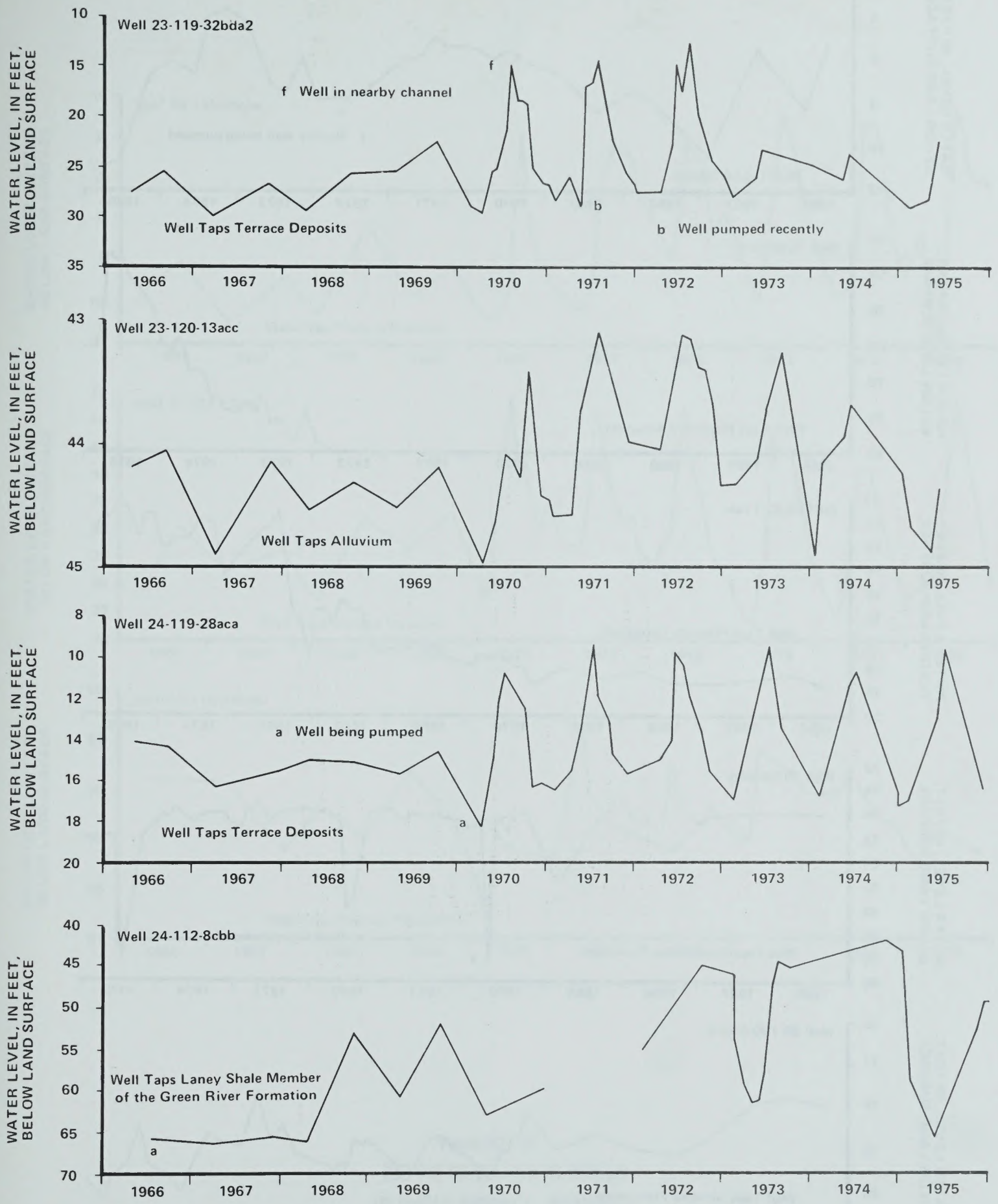


Figure R2 - 6A

DEPTH TO WATER IN WELLS

IN LINCOLN COUNTY, WYOMING

Source: Geologic Survey (USGS) 1976.

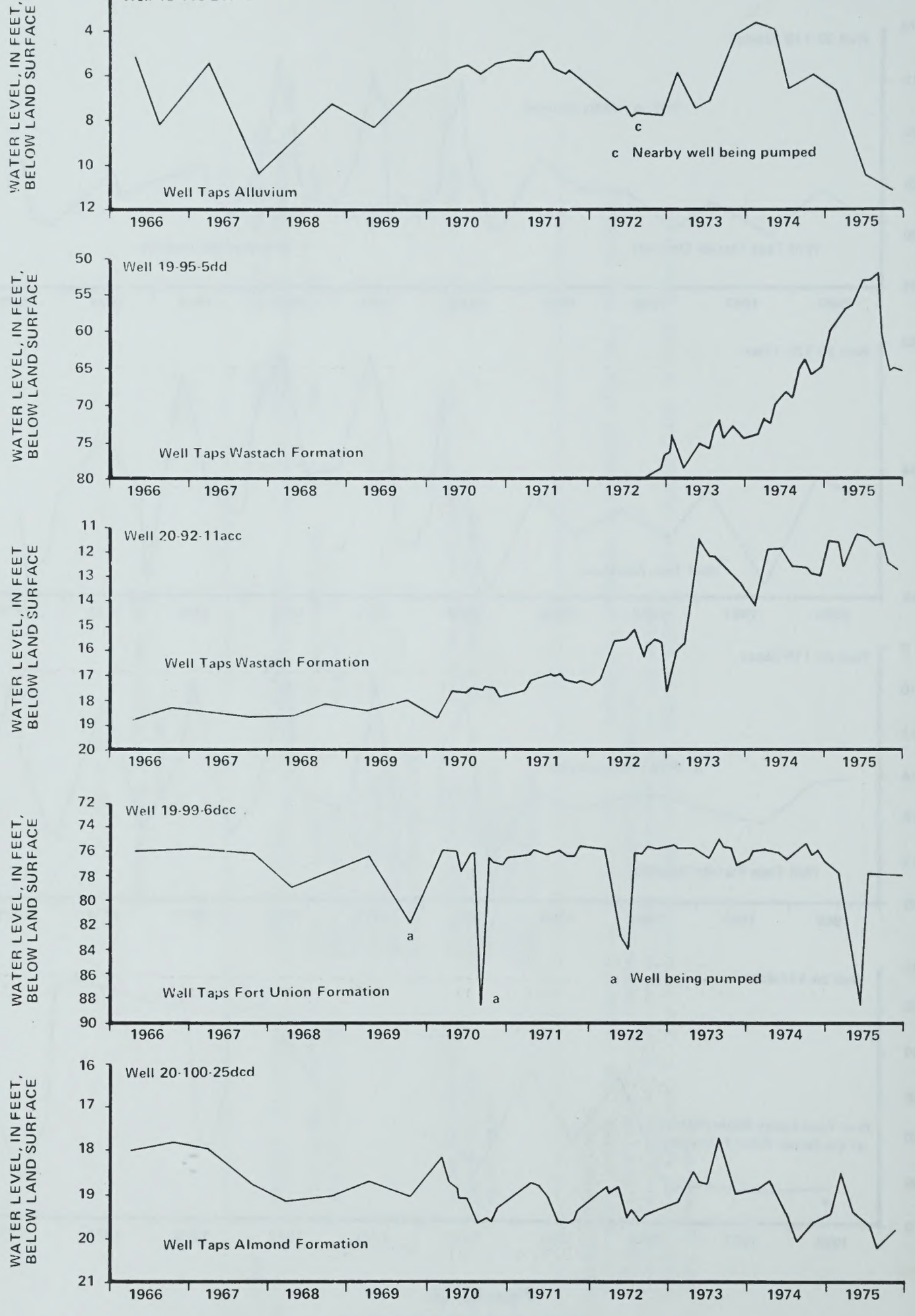


Figure R2 - 6B

DEPTH TO WATER IN WELLS

IN SWEETWATER COUNTY , WYOMING

Source: USGS 1976

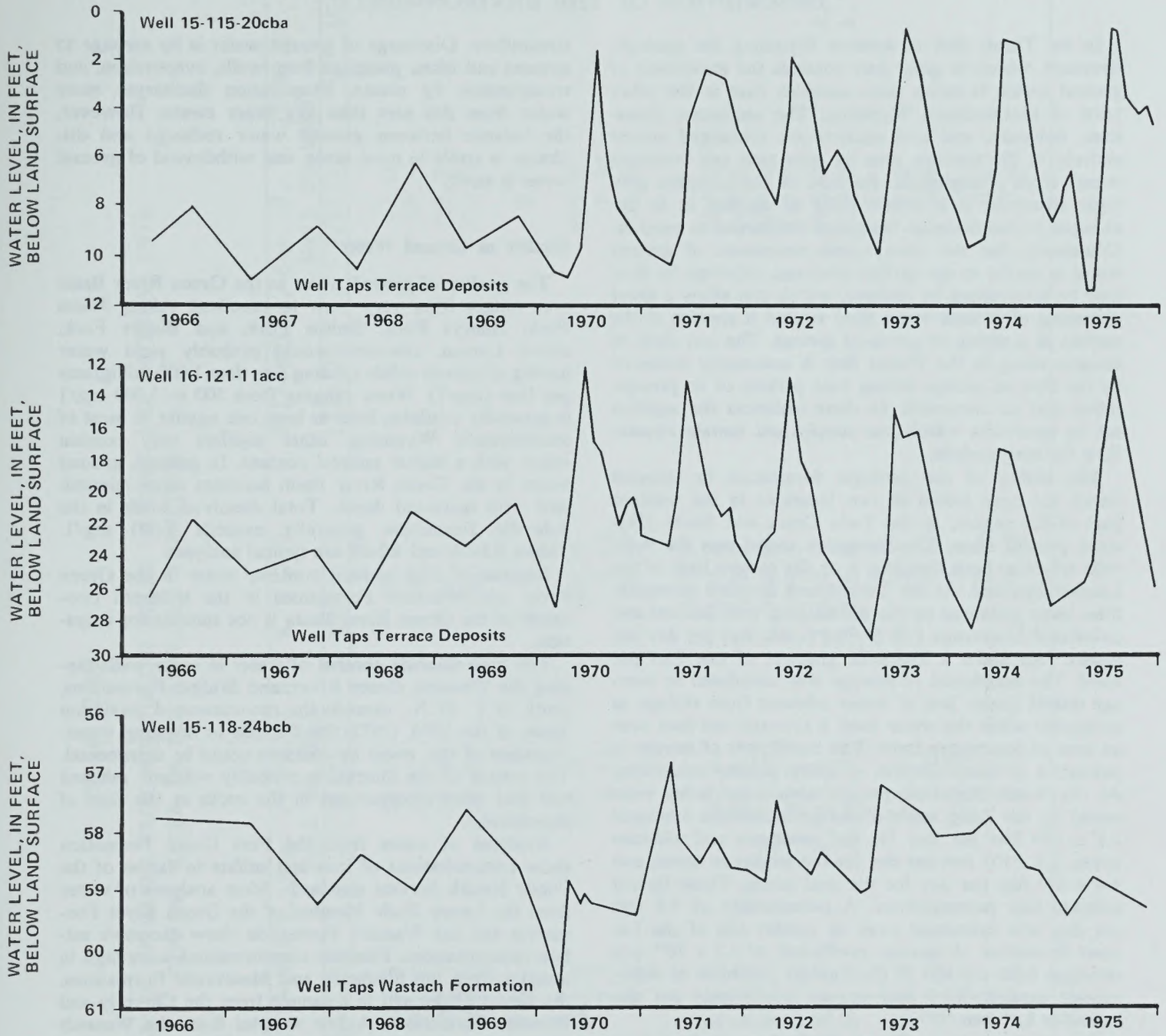


Figure R2 - 6C

DEPTH TO WATER IN WELLS

IN UINTA COUNTY , WYOMING

Source: USGS 1976.

DESCRIPTION OF THE ENVIRONMENT

In the Thrust Belt of western Wyoming the geologic structure, which in great part controls the movement of ground water, is much more complex than in the other parts of southwestern Wyoming. The sandstone, limestone, dolomite, and coal aquifers are recharged almost entirely in the outcrop area by snowmelt and overland runoff from precipitation. Because of the complex geologic structure, it is possible for an aquifer to be recharged in one drainage basin and discharged in another. Commonly, but not always, the movement of ground water is similar to the surface drainage, although its flow may be interrupted by faulting, which can allow a short circuiting of ground water flow so that it appears at the surface as a spring or group of springs. The low flow of streams rising in the Thrust Belt is commonly sustained by the flow of springs during long periods of no precipitation and no snowmelt. In these instances the aquifers act as reservoirs which can supply and sustain streamflow for long periods.

The ability of the geologic formations to transmit water has been tested at two locations in the western part of the region, at the Twin Creek and South Haystack project areas. The formation tested was the Adaville which at both locations is on the eastern limb of the Lazeart Syncline. At the Twin Creek location permeabilities were measured by the discharging well method and calculated to average 1.58 ft^2/day (cubic feet per day per square foot under a hydraulic gradient of one foot per foot). The coefficient of storage was calculated to average 0.0058 (cubic feet of water released from storage in an aquifer when the water level is lowered one foot over an area of one square foot). This coefficient of storage is indicative of semiconfirned, or leaky, aquifer conditions. At the South Haystack project area, core holes were tested by the "slug method"and permeabilities averaged 2.8×10^{-2} feet per day for the sandstone and siltstone zones, 2.8×10^{-5} feet per day for the mudstone zones, and 1.4×10^{-1} feet per day for the coal seams. These figures indicate low permeabilities. A permeability of 4.8 feet per day was calculated from an aquifer test of the Lazeart Sandstone. A storage coefficient of 1.2×10^{-3} was obtained from the test of the Lazeart. Methods of determining permeabilities and storage coefficients are discussed in Lohman (1972).

Ground water in the Thrust Belt can be obtained from the sandstones and coals of the underlying Tertiary and Cretaceous formations. Along creeks and streams, shallow wells obtain water from the Quaternary alluvium, flood plain, and fan deposits.

According to Welder (1968), the maximum yields of wells in the southwestern Wyoming region range from about 1 to about 500 gallons per minute (gpm), but yields of most wells range from about 10 to 100 gpm. Yields greater than 500 gpm could probably be obtained from deep wells (2,000 to 5,000 feet) penetrating thick sandstone sections in the Wasatch and Fort Union Formations.

In the Green River Basin, which lies between the Rock Springs Uplift and the western Wyoming Thrust Belt, recharge to the ground water reservoir is mainly by seepage from runoff, from precipitation, and from streamflow. Discharge of ground water is by seepage to streams and lakes, pumpage from wells, evaporation, and transpiration by plants. Evaporation discharges more water from this area than any other means. However, the balance between ground water recharge and discharge is stable in most areas, and withdrawal of ground water is small.

Quality of Ground Water

The quality of ground water in the Green River Basin area ranges from very poor to excellent. Along Hams Fork, Henrys Fork, Smiths Fork, and Blacks Fork, above Lyman, alluvium would probably yield water having dissolved solids totaling less than 1,000 milligrams per liter (mg/l). Water ranging from 500 to 3,500 mg/l is generally available from at least one aquifer in most of southwestern Wyoming; other aquifers may contain water with a higher mineral content. In general, ground water in the Green River Basin becomes more mineralized with increased depth. Total dissolved solids in the Adaville Formation generally exceeds 1,000 mg/l. Tables R2-6A and R2-6B are typical analyses.

Because of high sodium content, water in the Green River and Wasatch Formations in the southern two-thirds of the Green River Basin is not suitable for irrigation.

The high fluoride content of water in some wells tapping the Wasatch, Green River, and Bridger Formations, south of T. 29 N., exceeds the recommended maximum limits of the EPA (1972) for fluoride in drinking water. Ingestion of this water by children could be detrimental. The source of the fluoride is probably volcanic ash and tuff that were incorporated in the rocks at the time of deposition.

Analyses of water from the Fort Union Formation show concentrations of iron and sulfate in excess of the Public Health Service standards. Most analyses of water from the Laney Shale Member of the Green River Formation and the Wasatch Formation show excessive sulfate concentrations. Fluoride concentrations were high in samples from the Sundance and Mesaverde Formations, the Lewis Shale, and in a sample from the Cloverly and Frontier Formations. A few samples from the Wasatch Formation and one from the Laney Shale Member had high amounts of fluoride. The water analyzed was generally hard to very hard. Public Health Service standards for selenium (0.01 mg/l) and for copper (1.0 mg/l) may be exceeded locally (Vince and Pritchard 1954 and Beath, Hagner, and Gilbert 1946).

At least one aquifer containing water with a specific conductance of less than 1,500 micromhos per centimeter at 25°C generally underlies the shaded areas shown on Map 6, Appendix A. Chemical analyses and specific-conductance measurements of water from wells and springs were used with geologic data to delineate the areas. Although different chemical constituents in water produce different specific conductances, most natural waters have a total dissolved solids content ranging from 0.55 to 0.75 of the specific conductance (Rainwater and Thatcher 1960). A specific conductance of 1,500 was chosen as the

Table R2-6A

SUMMARY OF ANALYSES OF WATER FROM MONITORING WELLS SH 1065 AND SH 1088, 1976
TAPPING WATER IN THE ADAVILLE FORMATION

Units (mg/l) (unless noted)	NW1/4NE1/4, Sec. 19 T. 17 N., R. 117 W. Well SH 1065			SW1/4NE1/4, Sec. 2, T. 16 N., R. 118 W. Well SH 1088		
	5/25/76	7/27/76	10/26/76	1/25/76	7/27/76	10/26/76
Calcium	74.5	52.0	54.0		41.0	41.0
Magnesium	91.0	49.0	48.0		37.5	32.0
Potassium	13.5	18.0	21.5		33.5	32.0
Sodium	480.0	550.0	350.0		390.0	200.0
PHTH alkalinity (mg/l as $CaCO_3$)	0	0	0		0	0
Total alkalinity (mg/l as $CaCO_3$)	582.0	572.0	560.0		545.0	391.0
pH	7.3	8.15	7.75		7.95	7.65
Temperature, °C	8.5	8.5	7.5		10.5	6.1
Hardness, total (mg/l as $CaCO_3$)			333.0			272.0
Chloride	600.0	380.0	160.0		107.0	104.0
Sulfate	510.0	308.0	312.0		269.0	319.0
Solids, total dissolved	1,982.0	1,526.0	1,506.0		1,008.0	937.0
Solids, suspended	4,544.0	92.1	177.0		577.0	209.0
Solids, total	6,526.0	1,618.0	1,683.0		1,585.0	1,146.0
Conductivity (u-mhos/cm)	3,014.0	2,592.0	3,676.0		1,728.0	1,571.0
Flouride	1.3		1.7			0.6
Ammonia (as N)	3.4	1.2	3.7		2.6	1.8
Nitrate (NO_3-N)	0.16	0.28	0.80		0.66	4.9
Total kjeldahl nitrogen		10.6	22.7			
Phosphorus, ortho		0.03	0.08		0.15	0.10
Phosphorus, total	0.11	0.10	0.18		0.45	0.18

Source: Cumberland Coal Company 1976.

Table R2-6B

SUMMARY OF SELECT TRACT METAL ANALYSES OF WATER FROM MONITORING WELLS SH 1065 AND SH 1088 TAPPING WATER IN THE ADAVILLE FORMATION

	NW1/4NE1/4, Sec. 19 T. 17 N., R. 117 W. Well SH 1065				SW1/4NE1/4, Sec. 2, T. 16 N., R. 118 W. Well SH 1088	
Units (mg/1)	5/25/76	7/27/76	10/26/76	1/25/76	7/27/76	10/26/76
Aluminum, total		1.25	1.2	1.5	7.0	3.8
Arsenic, total				0.0054		0.011
Boron, total				0.22		0.48
Chromium, total				0.03		0.04
Copper, total				0.06		0.10
Iron, dissolved		4.7	0.06	F0.25	2.90	F0.25
Iron, total		5.4	2.56	4.0	6.00	6.50
Lead, total				0.09		0.57
Manganese, total		0.60	0.18	0.18	0.12	0.13
Mercury, total				F0.001		F0.001
Nickel, total		0.40	0.013	0.03	0.008	0.02
Selenium, total				F0.001		F0.0011
Zinc, total		10.7	2.99	F0.01	1.10	0.30

Source: Cumberland Coal Company 1976.

Note: Value in table is blank where not analyzed.

basis for mapping, because it is easily determined in the field and because it represents water having about 1,000 ppm dissolved solids, a maximum concentration of dissolved solids in drinking water recommended by the EPA (1972). The boundaries of the shaded areas are approximate, owing to the complexity of the geology and the small amount of data. Present data indicate that ground water having less than 1,000 mg/l total dissolved solids can be found in about one-third of the region; elsewhere, the water is poorer in quality.

Data on the quality of water suitable for stock are scarce and not conclusive. Site-specific discussions include some chemical data. The following arbitrary guide based on total dissolved solids has been used in Montana (Rainwater and Thatcher 1960): less than 2,500 mg/l, good; 2,500 to 3,500 mg/l, fair; 3,500 to 4,500 mg/l, poor; more than 4,500 mg/l, unsatisfactory. On this basis, ground water in the project area is generally good to fair for stock. Some of the deeper water, particularly in the Rock Springs Uplift, is poor to unsatisfactory. Undesirable contaminants, such as excessive amounts of iron, sodium, selenium, and sulfate, may be present locally.

The factors that determine the suitability of a water for irrigation include the type of the soil, the capacity of the water source, and the dissolved material in the water (Hem 1959). Of the results given in Table R2-6A, sodium and total dissolved solids data are most significant when considering water for irrigation use. The analyses indicate that most water from the Fort Union and Wasatch Formations is undesirable for irrigation according to standards recommended by the U.S. Department of Agriculture, Salinity Laboratory Staff, (1954). Water from some rocks of the Mesaverde Group in the northern Rock Springs Uplift and from some of the alluvial deposits may be acceptable for irrigation.

Use of Ground Water

The predominant use of ground water is for stock watering. A relatively small number of wells and springs are used for domestic supplies, and a few wells supply small businesses along U.S. Highway 30 (Interstate 80). Industrial uses include oil well and coal mining operations, trona processing, highway construction, and railroad operations. Ground water is used very little for irrigation except on lawns and small gardens. Table R2-6C outlines the major uses of water in the coal area in 1976.

Surface Water

The Green River, the major tributary of the Colorado River, drains the ES region. The Great Divide Basin is topographically closed, and no streams flow out of it.

Most of the perennial streams in the Green River Basin originate in the mountainous areas, where the greatest precipitation occurs and where ground water inflows sustain base flows. Streams originating at lower elevations are ephemeral or intermittent and flow mainly in response to direct runoff from rainstorms and snowmelt.

Streams in the Green River Basin that are important as water-supply sources acquire the major part of their annual runoff during spring and early summer from snowmelt. Late summer, fall, and winter flows are mainly the result of ground water inflow.

The quality of surface waters in the ES region is generally good. Water in the headwaters of streams is normally clear and relatively low in dissolved solids. Concentrations of dissolved solids increase in lower reaches of the streams from both man-made and natural sources. During spring runoff, concentrations of dissolved solids typically fall below 100 mg/l in headwaters near mountain divides but later in the season may rise above 200 mg/l. Dissolved solids concentration in the Green River near Green River, Wyoming, normally ranges from about 300 to 600 mg/l. During periods of low flow, these concentrations exceed 2,000 mg/l in water of a few streams that have mean discharges of less than 100 cubic feet per second (ft^3/s).

The southwestern Wyoming coal ES areas lie on the flanks of the basin and are drained for the most part by ephemeral streams which are tributaries to the Green River. The extreme western part of the region is drained by Twin Creek which flows to the Great Basin, an area of interior drainage.

Quality of Surface Water

The quality of surface water in the region is generally good. In the headwater areas dissolved-solids concentrations are generally low; however, they increase in lower reaches of the stream system as a result of natural sources of dissolved solids, return flows from irrigation, and return sewage flows from municipalities. During spring runoff dissolved solids typically are below 100 mg/l in the headwater areas but during low flow may rise to more than 100 mg/l. Dissolved-solids concentrations of the Green River near Green River, Wyoming, range normally from 300 to 600 mg/l. But, during periods of low flow may exceed 2,000 mg/l in a few streams that have average discharges of less than 100 ft^3/s.

In 1975, fecal coliform, a bacteria whose presence in water usually indicates a degree of sewage contamination, were observed in quantities ranging from 300,000 to 1,400,000 colonies per 100 milliliters in Bitter Creek at a point 5 miles west of Rock Springs (Geological Survey (USGS) 1976). In the Green River below Green River, Wyoming, in 1975 fecal coliform were observed to range from 66 to 1,700 colonies per 100 milliliters. The average of 3 observations below Rock Springs was about 750,000 colonies per 100 milliliters and in the Green River below the town of Green River the average of 12 observations was 810 compared to an average of 290 colonies per 100 milliliters from 12 observations at the gaging station at Green River above the confluence of Bitter Creek and Green River.

Table R2-6C

1976 ESTIMATED WATER WITHDRAWALS

	Acre-Feet
Public supplies	
Domestic	9,260
Commercial and industrial	5,660
Rural use	
Domestic	756
Livestock	4,780
Irrigation	1,210,000
Industrial, self supplied	
Coal mining	665
Trona mining	58,900
Thermal electric power plants	39,800
Total estimated withdrawal	1,329,821

Source: Written communication from S. W. West, District Chief, USGS, Cheyenne, Wyoming. Updated to 1976 on the basis of population and reported and estimated industrial use of water.

VEGETATION

Terrestrial

Plant distribution (see Map 7, Appendix A) is controlled by soils, climate, aspect, altitude, and land use history. Table R2-7A presents types and acreages of native vegetation in the southwestern Wyoming ES region.

Life form descriptions of each type follow. The vegetative descriptions and cover map were primarily developed from the following BLM Unit Resource Analyses: Salt Wells 1976, Sandy/Pilot Butte 1976, and Pioneer Trails 1976. Plant names are from Beetle (1970). A list of plants known or believed to occur in the region is available to the public at the Rock Springs District Office of the BLM.

Grassland

Grasslands consist of perennial bunchgrasses intermixed with forbs, half shrubs, and occasional shrub species. The native grasslands of the region are dominated by Thickspike wheatgrass *(Agropyron dasystachyum)*, bluegrasses *(Poa* spp.), Indian ricegrass *(Oryzopsis hymenoides)*, and bottlebrush squirreltail *(Sitanion hystrix)*.

Meadow

Sedges, rushes, and moisture enduring grasses are characteristic meadow plants. Two classes of meadows exist: dry meadows and wet meadows. Wet meadows are characterized principally by sedges and remain wet or moist throughout the summer. Dry meadows are dominated by grasses rather than sedges. Species characteristic of wet meadows are *sedges (Carex* spp.), bluejoint reedgrass *(Calamagrostis canadensis)*, Baltic rush *(Juncus balticus)*, Colorado *blueeyedgrass (Sisyrinchium montanum)*, and irises *(Iris* spp.). Bluegrasses dominate dry meadow species.

Sagebrush

The aspect of this type is a mixture of low-growing shrubs dominated by sagebrushes *(Artemisia* spp.) with a variable understory of perennial grasses and forbs.

Dominant species are basin big sagebrush *(A. tridentata* tridentata) and black sagebrush *(A. nova)*.

Associated species are thickspike wheatgrass, Indian ricegrass, bluebunch wheatgrass *(A. spicatum)*, *needlegrasses (Stipa* spp.), prairie Junegrass *(Koeleria cristata)*, cheatgrass brome *(Bromus tectorum)* bluegrasses, phloxes *(Phlox* spp.), lupine *(Lupinus* spp.), wildbuckwheats *(Eriogonum* spp.), rabbitbrushes *(Chrysothamnus* spp.), broom snakeweed *(Guttierrezia* sarothrae), and goldenweeds *(Haplopappus* spp.).

Mountain Shrub

Common species are Utah serviceberry *(Amelanchier* utahensis), Saskatoon serviceberry *(A. alnifolia)*, *snowberries (Symphoricarpos* spp.), true mountain mahogany *(Cercocarpus* montanus), and curlleaf mountain mahogany *(C. ledifolius)*.

Associated species are antelope bitterbrush *(Purshia* tridentata), bigsagebrush, common chokecherry *(Prunus* virginiana), thickspike wheatgrass, prairie Junegrass, bluegrasses, western yarrow *(Achillea lanulosa)*, asters *(Aster* spp.), sedges, wildbuckwheats, milkvetches *(Astragalus* spp.), and fleabanes *(Erigeron* spp.).

Conifer

Conifer species occurring within the region are Douglas fir *(Pseudotsuga menziesii)*, Engelmann spruce *(Picea* engelmannii), subalpine fir *(Abies lasiocarpa)*, lodgepole *pine (Pinus contorta)*, ponderosa pine *(P. ponderosa)*, and limber pine *(P. flexilus)*.

Associated species include quaking aspen *(Populus* temuloides), snowberries, blueberries *(Vaccinium* spp.), and true mountain mahogany.

Barren

Barren areas consist primarily of rock outcrops with sparse vegetative cover provided by mountain mahogany, serviceberry species, wildbuckwheats, big sagebrush, prairie Junegrass, and saltbushes.

Juniper

The type consists of an overstory of pigmy woodland conifers 8 to 20 feet in height with an understory of shrubs and herbaceous species. This community is typically found on well-drained, poorly-developed, shallow, gravelly soils.

Dominant species are Rockymountain juniper *(Juniperus* scopulorum) and Utah juniper *(J. osteosperma)*.

Associated species are big sagebrush, low sagebrush, rabbitbrushes, true mountain mahogany, broom snakeweed, plains prickly pear *(Opuntia polyacantha)*, serviceberries, antelope bitterbrush, western wheatgrass, beardless wheatgrass, Indian ricegrass, phloxes, and goldenweeds.

Aspen

Quaking aspen, a deciduous tree, is dominant and provides an overstory to snowberries, mountain brome, pine *reedgrass (Calamagrostis rubescens)*, bluegrasses, columbines *(Aquilegia* spp.), geraniums *(Geranium* spp.), lupines, wildbuckwheats, and common juniper *(Juniperus communis)*.

Table R2-7A

VEGETATION TYPES
SOUTHWESTERN WYOMING

Type*	Type Number	Approximate Acreage
Sagebrush	4	4,028,060
Greasewood	14	589,050
Saltbush	13	396,900
Juniper	9	384,300
Conifer	6	234,360
Mountain shrub	5	102,060
Barren	8	97,650
Broadleaf trees; riparian	10b	56,700
Winterfat	15	43,000
Grassland	1	35,280
Broadleaf trees; aspen	10a	32,760
Meadow	2	15,120
Desert shrub	16	**

Source: Developed from BLM Range Surveys and BLM Unit Resource Analysis: Salt Wells 1976, Sandy/Pilot Butte 1976, and Pioneer Trails 1976.

*Types and numbers from BLM manuals.
**Small areas not mapped on regional basis.

Saltbush

Dominant species of the saltbush type are Nuttall *saltbush (Atriplex nuttallii)*, shadscale saltbush *(A. confertifolia)*, and fourwing saltbush *(A. canescens)*. Associated species include Indian ricegrass, thickspike wheatgrass, western wheatgrass, basin wildrye *(Elymus cinereus)*, cheatgrass brome, common halogeton *(Halogeton glomeratus)*, rabbitbrushes, black greasewood *(Sarcobatus vermiculatus)*, and sagebrushes.

Greasewood

The dominant of this type is black greasewood. Other shrubs appearing in more open stands are rabbitbrushes, fourwing saltbush, Nuttall saltbush, and big sagebrush.

Understory species consist of western wheatgrass, bottlebrush squirreltail, alkali sacaton *(Sporobolus airoides)*, and cheatgrass brome.

Winterfat

Winterfat *(Eurotia lanata)*, a half shrub, is dominant with thickspike wheatgrass, western wheatgrass, needleandthread, Indian ricegrass, asters, and phloxes subdominant.

Desert Shrub

Spiny hopsage *(Grayia spinosa)*, summercypresses *(Kochia* spp.), and gray horsebrush are dominants. Associated species are western wheatgrass, bottlebrush squirreltail, and common halogeton.

Broadleaf Trees; Riparian

This type occurs along perennial streams (i.e., Hams Fork and Green River) and consists mainly of willow "patches"(Salix spp.) with grass understories. Principle grass species are bluegrasses and wheatgrasses. Cottonwood trees *(Populus* spp.) are scattered throughout this type.

Aquatic

Aquatic flora consist of various types of algae and rooted plants. Algae are found in natural waters in an impressive array of shapes, sizes, biochemical characteristics, and ecological roles (Reid 1961). Green algae, bluegreen algae, and diatoms are common fresh water algae forms. Rooted aquatics include vascular plants and bryophytes (i.e., plants without the conducting tissues, xylem and phloem).

Endangered and (or) Threatened

The following plant species, proposed for endangered or threatened status, have been identified within the ES region: *Arabis demissa* var. languida and var. russeola, *Astragalus* proimanthus, *Penstemon acaulis, Draba pectinipila, Stanleya* pinnata var. gibberosa, *Physaria condensata, Lesquerella* macrocarpa, and *Haplopappus contractus.*

The sites on which these species occur (habitat requirements for *Haplopappus contractus* are unavailable) include limestone knolls and hillsides, clay and gravelly hills, barren clay flats and ridges, rocky slopes, and white shale bluffs.

FISH AND WILDLIFE

General Information

Habitat Types

The following are lists of the major habitat types in the region and the main wildlife species associated with each. A complete wildlife species list can be obtained from the Rock Springs District Office of the BLM.

Aquatic. Consists of stream (1,040 miles which support game fish and an unknown number of miles which support none or only nongame fish) and standing water (about 56,000 acres) and supports the following: carp, lake chub, Utah chub, redside shiner, speckled dace, mountain sucker, white sucker, flannelmouth sucker, mottled sculpin, longnose dace, rainbow trout, cutthroat trout, brook trout, and brown trout.

Terrestrial.

Sagebrush (4,028,060 acres). Species associated with sagebrush are horned lark, blackbilled magpie, sage thrasher, western meadowlark, Brewer's blackbird, vesper sparrow, sage sparrow, Brewer's sparrow, sage grouse, longtail weasel, badger, striped skunk, coyote, red fox, bobcat, mountain lion, Richardson ground squirrel, Uinta ground squirrel, least chipmunk, deer mouse, whitetail jackrabbit, cottontail, elk, mule deer, and pronghorn antelope.

Greasewood (589,050 acres). Species associated with greasewood are longtail weasel, badger, striped skunk, coyote, red fox, least chipmunk, deer mouse, cottontil, and pronghorn antelope.

Saltbush (396,900 acres). Species associated with saltbush are horned lark, rock wren, sage thrasher, sage sparrow, Brewer's sparrow, longtail weasel, badger, coyote, whitetail prairie dog, mule deer, and pronghorn antelope.

Juniper (384,300 acres). Species associated with juniper are mourning dove, common flicker, Say's phoebe, horned lark, rock wren, sage thrasher, western meadowlark, house finch, sage sparrow, Brewer's sparrow, longtail weasel, striped skunk, coyote, red fox, bobcat, mountain lion, Uinta ground squirrel, mule deer, and pronghorn antelope.

Mountain shrub (102,060 acres). Species associated with mountain shrub are ruffus sided towhee, green-tailed towhee, common flicker, lark sparrow, longtail weasel,

badger, striped skunk, coyote, red fox, elk, and mule deer.

Broadleaf trees (riparian). Species associated with broadleaf trees are belted king fisher, common flicker, tree swallow, white-crowned sparrow, Lincoln's sparrow, song sparrow, longtail weasel, shorttail weasel, badger, striped skunk, coyote, red fox, mink, otter, beaver, muskrat, and moose.

Grassland (35,280 acres). Species associated with grassland are horned lark, western meadowlark, savannah sparrow, vesper sparrow, longtail weasel, badger, striped skunk, coyote, red fox, deer mouse, whitetail jackrabbit, desert cottontail, mule deer, and pronghorn antelope.

Raptors. The following raptors may be seen foraging in one or several habitat types: turkey vulture, goshawk, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, golden eagle, bald eagle, marsh hawk, osprey, prairie falcon, peregrine falcon, merlin, American kestrel, screech owl, great horned owl, long-eared owl, snowy owl, burrowing owl, short-eared owl and saw-whet owl.

Fishery

Introduction

There are 1,040 miles (approximately 10,000 acres) of streams and 56,000 acres of standing water supporting game fish and unknown numbers of miles supporting no fish or only nongame species (Wyoming Game and Fish Department 1977). Major aquatic features include Hams Fork, Smiths Fork, Blacks Fork, Thomas Fork, Green River, Bear River, Viva Naughton Reservoir, Woodruff Narrows Reservoir, Kemmerer City Reservoir, and portions of Flaming Gorge and Fontenelle Reservoirs.

Nongame

Bitter Creek flows through the proposed Black Butte Mine area. The Wyoming Game and Fish Department found 91.9 pounds of longnose dace per acre and 22.3 pounds of mountain sucker per acre in Bitter Creek.

Game

The Hams Fork is the only game fish habitat found close to a proposed mine permit boundary (the proposed North Block Mine). The game species present are mountain whitefish, rainbow trout, and brown trout (Wyoming Game and Fish Department 1977). The Wyoming Game and Fish Department sampled the stream for population estimates and found the standing crop per acre was 0.76 pounds of rainbow trout, 0.66 pounds of brown trout, and 45.0 pounds of white fish.

See the Recreational Resources section for a discussion of recreational use of the fisheries.

Sensitive Species

The region contains two varieties of cutthroat trout which are officially listed as rare by the Wyoming Game and Fish Department and considered sensitive by the BLM. "Officially listed species"includes species classified by the Wyoming Game and Fish Department in any category that implies potential extinction. The two varieties are the Colorado River *cutthroat, Salmo clarki pleuriticus,* and the Bonneville cutthroat, *Salmo* clarki *utah.* The present status of the Colorado River cutthroat is best classified as "depleted"(Binns 1976). The status of the Bonneville cutthroat has not yet been determined but is probably similar to that of the Colorado River variety.

The Colorado River cutthroat is the only trout native to the Green River drainage (Wyoming Game and Fish Department 1977). It is found primarily in isolated tributaries to the Green River, Blacks Fork, and Smith's Fork. The Bonneville cutthroat is found primarily in the Bear River drainage and its main tributaries, the Thomas Fork and Smith's Fork. These species are also listed as rare in the Wyoming Game and Fish publication *Current Status and Inventory of Wildlife in Wyoming.*

Endangered and (or) Threatened

The humpback chub and Colorado River squawfish, both listed as endangered, once inhabited the Green River. Since the filling of Flaming Gorge Reservoir in the early 1960s, these species have not been collected from the Green River. The Wyoming Game and Fish Department indicates that these fish are extinct in Wyoming.

Wildlife

Birds

Nongame. The major nongame bird species found in the region are listed under the major habitat types at the beginning of this section. The best available information from the Wyoming Game and Fish Department breeding bird surveys indicates an average density of 32 birds per square mile. Although this figure is an average estimate for resident birds, it must be understood that nomadic arid land species (e.g., crows) may increase this number considerably.

Southwestern Wyoming contains abundant raptor habitat in the form of cliffs for nesting and lowlands for hunting. High concentrations of golden eagles can be found in the region during the winter.

Due to the numbers and diversity of raptors in the Kemmerer-Sweetwater region, most of the area is used for hunting by predatory birds. In 1977, a regional survey by the Wyoming Game and Fish Department located 298 nests, of which 144 (48.3%) were active. The survey concentrated on and adjacent to proposed mining areas so these figures are not regional totals. Table R2-8A summarizes the raptor survey.

Table R2-8A

SUMMARY OF 1977 RAPTOR NEST SURVEY

Golden eagle (active)	53 nests
Golden eagle (inactive)	79 nests
Golden eagle TOTAL	132 nests
Golden eagle (percent active)	40.1%
Prairie falcon (active)	30 nests
Prairie falcon (inactive)	20 nests
Prairie falcon TOTAL	50 nests
Prairie falcon (percent active)	60.0%
Red-tailed hawk (active)	27 nests
Red-tailed hawk (inactive)	16 nests
Red-tailed hawk TOTAL	43 nests
Red-tailed hawk (percent active)	62.8%
Ferruginous hawk (active)	14 nests
Ferruginous hawk (inactive)	31 nests
Ferruginous hawk TOTAL	45 nests
Ferruginous hawk (percent active)	31.1%
Great horned owl (active)	8 nests
Great horned owl (inactive)	1 nest
Great horned owl TOTAL	9 nests
Great horned owl (percent active)	88.9%
American kestrel (active)	7 nests
American kestrel TOTAL	7 nests
American kestrel (percent active)	100.0%
Swainson's hawk (active)	2 nests
Swainson's hawk TOTAL	2 nests
Swainson's hawk (percent active)	100.0%
Marsh hawk (active)	1 nest
Marsh hawk TOTAL	1 nest
March hawk (percent active)	100.0%
Burrowing owl (active)	1 nest
Burrowing owl TOTAL	1 nest
Burrowing owl (percent active)	100.0%
Long-eared owl (active)	1 nest
Long-eared owl TOTAL	1 nest
Long-eared owl (percent active)	100.0%
Unidentified (inactive)	7 nests
ALL SPECIES	
TOTAL ACTIVE	298 nests
PERCENT ACTIVE	144 hests
	48.3%

Game. The major game bird species present in the region is the sage grouse. Table R2-8B shows the acres of habitat occupied according to season of use. There are approximately 250 to 300 known strutting grounds in the ES region. Some of these are shown on Map 8A, Appendix A. The best population density information currently available indicates that within all occupied sage grouse habitats there is an estimated 10 birds per square mile (personal communication, James June, Wyoming Game and Fish Department, January 1978). However, there are areas (strutting grounds, wintering areas, etc.) where the density will be much greater. Total regional population is estimated at 100,000 birds.

Sensitive Species. There are several bird species which may occur in the southwestern Wyoming region that are listed as rare in the booklet *Current Status and Inventory of* Wildlife *in Wyoming*, July 1977, published by the Wyoming Game and Fish Department. Birds which occur in the region are purple martin, scrubjay and burrowing owl.

Endangered and (or) Threatened. The American peregrine falcon is known to nest in the region on the cliffs surrounding Flaming Gorge Reservoir and the Green River. Unconfirmed sightings of the falcon and fledglings were made 2 miles west of the proposed Black Butte Mine in 1972 and 1973 (personal communication, Ogilvie and Randall, 1977). This area is considered to be poor peregrine falcon habitat and the chance of nesting is believed to be remote (personal communication, Dr. Richard D. Porter, U.S. Fish and Wildlife Service, March 1977).

Mammals

Nongame. The most common nongame mammals in the region are longtail weasel, badger, striped skunk, coyote, red fox, bobcat, whitetail prairie dog, Richardson ground squirrel, Uinta ground squirrel, least chipmunk, deer mouse, and whitetail jackrabbit.

The only small nongame mammal population information available for southwestern Wyoming indicates about 5 individuals per acre in the sagebrush type, about 0.5 per acre in the saltbush type, and about 1.5 per acre in the greasewood type (Maxell 1973). No information is available for the other habitat types; therefore, an average figure of two individuals per acre will be used for the purposes of this report.

Game. Antelope are the most conspicuous big game species inhabiting southwestern Wyoming (see Map 8, Appendix A, for distribution of antelope and other big game species discussed later). Table R2-8B shows acres of habitat occupied according to season of use. The present antelope population within the ES region is estimated to be 17,270 (Wyoming Game and Fish Department 1977). The total number of antelope occupying the five site specifics in a given year is approximately 1,000.

The average antelope density on the winter range is ten per square mile and the average on the summer range is three per square mile for an overall average of seven per square mile (calculated by dividing the total number of animals by the total number of square miles of summer and winter range). These estimates were used for impact analysis in Chapter 4.

Mule deer are well distributed throughout southwestern Wyoming due to an abundance of fair to good habitat. Deer populations appear to have stabilized after a drastic decline in the late 1960s and early 1970s. The current deer population is estimated at 21,335 (Wyoming Game and Fish Department 1977). The total number of deer occupying the five site specifics in a given year is approximately 500. The estimated average regional density is six deer per square mile.

Elk are found in the broken sagebrush-covered hills at lower elevations as well as subalpine zones. The elk population in the region, which has been steadily increasing in recent years, is presently estimated at 5,750 animals (Wyoming Game and Fish Department 1977). The average number of elk occupying the five proposed mining areas in 1976-1977 was estimated to be 40. The average estimated density for all occupied elk habitat is six elk per square mile.

Moose are found only in the western one-third of the ES region. They are confined mainly to riparian zones along major drainages. The present population in the ES region is estimated at 1,475 (Wyoming Game and Fish Department 1977). The average estimated density is 2.5 moose per square mile of moose range. The proposed North Block Mine is the only permit area to contain moose. An estimated five moose use the area each winter.

Endangered and (or) Threatened. Habitat is available for the black-footed ferret in southwestern Wyoming. BLM and Wyoming Game and Fish Department records show five sightings of the ferret in Sweetwater County since 1974. Ferrets are closely associated with prairie dogs, and there are many prairie dog colonies in the region. Because of difficulty in observing the species (it is nocturnal and may appear above the ground for only a few minutes every few days), ferrets may be present at some of the several prairie dog colonies in the area. The Wyoming Game and Fish Department conducted searches for black-footed ferret signs on each of the five proposed mine permit areas. Prairie dog towns were searched for indications of trenching, plugged burrows, or ferret scat and no sign was found. They believe that their survey was not intensive enough to positively determine the presence or absence of the ferret.

The U.S. Fish and Wildlife Service, Denver Research Center, under contract to the BLM, Wyoming State Office, began an intensive black-footed ferret survey in the general area of the proposed Black Butte Mine in June 1978 and in the vicinity of the proposed South Haystack Mine in July 1978. The results of this survey are anticipated in October 1978.

Reptiles and Amphibians

General. The primary reptiles found in the region are the northern sagebrush lizard, desert shorthorned lizard, northern plateau lizard, northern sideblotched lizard, northern cliff lizard, prairie rattlesnake, midget faded rattlesnake, Rocky Mountain rubber boa, wandering

Table R2-8B

ACRES OF RANGE OCCUPIED ACCORDING TO SEASON OF USE

Species	Summer	Summer Crucial	Winter	Winter Crucial	Winter/ Yearlong	Winter/ Yearlong Crucial	Yearlong	Parturition (calving, fawning, or nesting areas)	Parturition Crucial
Pronghorn Antelope	2,187,303	90,240	10,880	40,320	1,227,374	636,555	591,360	---	---
Mule Deer	1,475,542	102,925	29,418	47,063	1,605,404	800,211	32,640	---	---
Elk	419,650	---	609,314	157,253	557,597	116,814	61,440	27,023	4,008
Moose	377,607	---	---	---	643,089	47,794	104,320	---	---
Sage grouse	---	---	758,400	115,200	---	---	5,954,915	---	651,440

Source: Calculated by planimeter from Wyoming Game and Fish Department wildlife distribution overlays.

garter snake, valley garter snake, western smooth green snake, and Great Basin gopher snake. The primary amphibians are the tiger salamander, Rocky Mountain toad, and leopard frog. Table R2-8C shows the number of reptile and amphibian species and their estimated densities in the major habitat types found in the ES region.

Sensitive Species. The booklet *Current Status* and *Inventory of Wildlife in Wyoming*, published by the Wyoming Game and Fish Department, lists the Rocky Mountain rubber boa and western smooth green snake as rare.

The western smooth green snake occupies damp, grassy, or forest environments in Uinta County. The Rocky Mountain rubber boa prefers grasslands, woodlands, and forests. It is usually associated with moist soil and found along streams and under rocks and rotting logs.

Endangered and (or) Threatened. There are no reptiles or amphibians considered to be endangered and (or) threatened in the southwestern coal ES region.

Wild Horses

The region contains approximately 3,200 wild horses. The 1976 wild horse aerial count showed 1,685 horses in the ES region of Sweetwater County south of Interstate Highway 80. About 1,000 horses inhabit the Adobe Town area east of the proposed Black Butte coal mine, 63 horses occupy the Kenney Rim area south of the mine, and about 85 horses inhabit the Golden Wall Oil Field immediately west of the mine site. South and east of the proposed mine site about 229 and 278 horses inhabit the Salt Wells Creek area and the Aspen Mountain area, respectively (Map 9, Appendix A). It is estimated that the horse population is increasing 15%-30% yearly. The 1976 count of 1,685 horses is a 3.4-fold increase over the 1972 count. A similar situation exists north of Interstate 80. Horse herds are increasing 25%-30% per year. About 1,544 horses were counted within the boundary of the ES region in Sweetwater County north of I-80. These horses compete with elk for winter forage and with all wildlife species for water in periods of low water availability. Development, such as oil and gas and strip mining, seems to have little effect on the horses in the area. It is not uncommon to find horses grazing near drill sites or the Jim Bridger Power Plant and strip mine.

It is the responsibility of the BLM to manage wild horse populations on public lands. The current management policy is complete removal of all horses from the checkerboard lands. South of the checkboard, a small population of horses will be maintained in the Adobe Town area located in the southeastern portion of the ES region.

CULTURAL RESOURCES

Cultural resources are fragile and nonrenewable remains of human activity, occupation, and endeavor. They are reflected in sites, structures, artifacts, objects, ruins, works of art, and architecture or documentation that are evident within the region's boundaries. Cultural resources are usually discussed in terms of archeological and historical values. Each portion of the resource represents a continuum of events representing man's first entry into the region to the present.

Archeological

Archeological investigations in the southwestern Wyoming ES region have been scattered and sporadic until recently. Many of the recent cultural resource investigations in the region have been undertaken to comply with Section 106 of the Historic Preservation Act of 1966 and Section 2(b) of Executive Order 11593, "Protection and Enhancement of the Cultural Environment" These inventories, together with earlier efforts, have been important in developing a chronology for this region, which is marginal to the Northwest Plains, Great Basin, and Northwest Interior Plateau. The chronology established by Mulloy (1958) compares favorably with evidence accumulated thus far. On the basis of stylistic changes in artifact types, particularly projectile points, archeological sites have been divided into five general categories. These are summarized in Table R2-9A. Several construction-related projects have generated surveys in the region. Dibble and Day (1963) conducted surveys of Flaming Gorge and Fontenelle Reservoirs. Sharrock (1966) surveyed parts of southwestern Wyoming as part of his dissertation project.

Interest in coal resources has stimulated many other surveys. Wilson et al. (1973) conducted preliminary survey work for the Jim Bridger Project in 1972. More recently Walker et al. (1977) reported on intensive surveys of the Bridger Mine. Bennett (1974 and 1975) conducted surveys for projects near Kemmerer. Recently, Western Wyoming College conducted surveys for the development of coal resources throughout much of southwestern Wyoming and compiled much of the above data for this ES (Metcalf 1975, 1976, 1977a, and 1977b). The net result of these surveys is an ever increasing site inventory in a previously neglected area. Presently over 110,530 acres out of 6.3 million have been intensively inventoried. These surveys have concentrated on coal areas which range in size from 1,000 to 30,000 acres. Inventory samples on these areas range from 10% to complete coverage. Site densities vary from east to west within the region, with 2.35 sites per section in the west to 2.92 sites per section in the east. The range of site densities from the various surveys is from 0.5 sites to 4.35 sites per section. Using the average of 2.92 sites per section, one can predict a total of 29,000 sites for the entire region.

On approximately 48,000 acres, or about 59% of the total area of the five site-specific project areas, Level III inventories (systematic and intensive collection and retrieval of data) have been completed. This is 100% of the area of proposed surface disturbance. In addition, those sites identified as having potential to be nominated to the National Register have been tested (Table R2-9B).

Table R2-8C

REPTILE AND AMPHIBIAN DENSITY FOR MAJOR HABITAT TYPES

Habitat Type	Number of Species	Density Estimate (number per acre)
Sagebrush	4	2-3
Salt desert shrub	4	2-3
Greasewood	5	2-3
Winterfat	4	2-3
Grassland and meadow	10	6-8
Mountain shrub	10	6-8
Aspen-cottonwood	10	6-8
Juniper	10	6-8

Source: Personal communication, Dr. George Baxter, University of Wyoming, January 1978.

Table R2-9A

CULTURAL CHRONOLOGY OF SOUTHWESTERN WYOMING COAL ES REGION

Period	Subphase	Date B.P. (Before Present)	Projectile Point Style or Cultural Group	Characteristics (Sites)
Historic		A.D. 1700-Present	Shoshonean Cheyenne Gros Ventre Commanche Flathead Crow Arapahoe European (White)	Hunting and gathering, some buffalo and antelope hunting by communal drives, mostly marginal subsistence (see Historical Resources for European site)
Late Prehistoric		200 B.P. - A.D. 1700	Shoshonean Intermountain	Marginal subsistence, hunting and gathering, pottery in some sites (Eden-Farson) (Wardell)
	Late Middle	3500 B.P. - 2000 B.P.		Hunting and gathering (Pine Springs) (Meadow Draw)
Middle				
	Early Middle	4500 B.P. - 3500 B.P.	Scoggin Duncan Hanna McKean	Hunting and gathering (Pine Springs)
Altithermal		7000 B.P. - 4500 B.P.	McKean (?)	Generally a more arid period with marginal occupations suspected in limited areas
		EARLY PREHISTORIC PERIOD		
Plano		10000 B.P. 7000 B.P.	Lusk Frederick Cody Alberta Hell Gap Agate Basin Midland	Hunting extinct fauna (Bison antiquus), bison traps and some communal hunting suspected, collecting flora probable (Eden Site)
Folsom		11000 B.P.	Folsom	Hunting extinct fauna (Bison antiquus), bison traps and some communal hunting suspected, collecting flora probable
Llano		12000 B.P. - 11000 B.P.	Clovis	Hunting extinct fauna, mammoth traps and communal procedures suspected, collecting flora probable

Note: After Mulloy (1958).

Table R2-9B

ARCHEOLOGICAL SITES ELIGIBLE FOR NOMINATION TO THE
NATIONAL REGISTER OR ON THE REGISTER
(WYOMING'S HISTORIC INVENTORY)

Sweetwater County	Uinta County
Finley Site, 48SW5	Bridger Antelope Trap[1]
44 Ranch Site, 48SW513	
Pine Springs Site	Meadow Draw Site
Black Mountain Stone Circles	Skull Point Site
Eden-Farson Site, 48SW304	
Cedar Canyon Petroglyphs	

Source: Federal Register, Vol. 42, No. 21, February 1, 1977, Wyoming Historic Preservation Plan, Vol. III, 1977.

[1]On the National Register.

A total of 339 archeological sites have been identified in these inventories. The archeological value of currently unknown sites within the unsurveyed 41% of the proposed site-specific coal projects cannot be determined at this time. It is estimated that an additional 343 sites would be found in uninventoried coal areas and related rights-of-way.

The Early Prehistoric period, 12000 to 7000 B.P., is often referred to as the Paleo-Indian period. Projectile points reflecting this period in the region are Clovis, Folsom, and Eden-Scottsbluff. These and other artifacts are usually associated with extinct Pleistocene megafauna, i.e., *Mammoth, Bison antiquus*, and *Bison occidentales*. The Finley Site, 14 miles northwest of the proposed Long Canyon project area; Meadow Creek sites (Husted 1969, Wilson et al. 1973), 5 miles north of the proposed North Block project area; and the Pine Spring Site (Sharrock 1966), west of Flaming Gorge, are well documented examples of Paleo-Indian sites. Metcalf's coal tract surveys (1975, 1976, 1977a, and 1977b) added eight and possibly ten more sites to this period, suggesting that a significant number of these important Paleo-Indian sites are present in the ES region.

The Altithermal period, from 7000 to 4500 B.P., is generally thought to represent a cultural hiatus in the region. Metcalf (1975) suggests there may have been marginal occupation of the region during this period of elevated temperature and intensive drought. At least one projectile point, a McKean variant, may reflect occupation of the region during the Altithermal; if so, this information is of considerable importance to the regional archeological record.

Middle Prehistoric sites, from 4500 to 2000 B.P., are fairly abundant in the region. The Pine Spring Site has a Middle period component dating 3635
1966). A survey for Pacific Power and Light, conducted by Wilson et al. (1973), reported Middle Prehistoric sites at Kemmerer Reservoir, north of Opal in Lincoln County, and others between the Green River and Bridger Power Plant. Other Middle Prehistoric period sites are known around Flaming Gorge (Dibble and Day 1963), north of the proposed Long Canyon project area. Metcalf reported 39 Middle period sites from Black Buttes and 11 from South Haystack. A number of these are quarry sites or represent a single component.

The Late Prehistoric period, from 2000 B.P. to 1700 A.D., reflects a pattern of hunting and gathering from previous periods, yet the variety of traits suggests considerable cultural diversity. Projectile points, grinding slabs, and pottery are commonly associated with Late period sites. Metcalf has noted 10 Late Prehistoric sites in the South Haystack project area and 41 in the Black Buttes area. Five of the Black Buttes sites contained ceramic material. Pottery from three of these sites is tentatively identified as representing the Intermountain tradition. Projectile points from most Late Prehistoric sites are small triangular side notched or corner notched forms which are uniformly distributed throughout the entire region. Pottery from these sites suggests affinities with Shoshonean or Fremont cultures. These foragers were predominately Shoshonean, who exploited a variety of plants and animals. The presence of grinding slabs suggests that a variety of flora was also used. Throughout the period of early explorations and fur trade, references are made primarily to the Shoshone or Eastern Shoshone as occupants of the area. Cowie (1958) summarizes white contacts with the Shoshone throughout the Historic period and also treats intertribal contacts. Throughout the period, the principal group present was the Shoshone, although Commanche, Flathead, Crow, Arapahoe, Gros Ventre, Cheyenne, and Sioux are known to have encroached on this territory for raiding, hunting, or trade.

Love (1976) suggests on the basis of regional surveys that sites are located in three principal areas: dunes, springs, and playa lakes. He further suggests that dune sites were probably wintering areas, since winters would be relatively milder in them. Spring and playa lake sites would reflect intermittent spring, summer, and fall occupations, depending on the seasonal availability of food resources.

Basic site types in the region include stone circles (tepee rings), slab lined fire pits with nearby suggestions of huts which were constructed of branches, fire pits without associated structures, flake scatters, quarries, communal animal kill sites, village and camp sites, and petroglyph sites.

Petroglyph sites such as those in Cedar Canyon (nominated to the National Register) may have ceremonial or religious significance, but time has obscured meaning and interpretation of these artistic expressions. The many soft sandstone outcrops within the region have provided an excellent medium for rock art. The abundance and variety of petroglyph figures in Cedar Canyon make them an important resource.

There is presently one archeological site, the Bridger Antelope Trap, in Uinta County on the National Register of Historic Places *(Federal Register*, Vol. 42, No. 21—Tuesday, February 1, 1977). Several other sites have been nominated or nominations are in progress. Table R2-9B summarizes these nominations. The number of nominations attests to the significance of archeological sites, regardless of age, in the region.

Historical

The region's history is dramatic and varied, a last frontier in several respects, even to this day, and a vital link in the settling of the west. The kinds of historical events which took place in the region may be generally divided into four broad categories: the Fur Trade and Early Exploration period (1812-1841), the Acquisition, Emigration, Transportation, Communication, and Early Military History period (1842-1869), the Settlement and Development period (1869-1925), and the Recent Historical period (since 1925).

The southwestern coal region was first traversed by Europeans in 1812. From this point on, the area was heavily traveled, first by trappers and explorers and later by immigrants traveling west.

One of the first recorded rendezvous held by white trappers and traders with the Indians in the Rocky Mountains was near Burntfork, Wyoming, in 1825. Another was recorded west of the present town of Granger in 1834.

The first permanent settlement in the region was Jim Bridger's Fort on Blacks Fork. Bridger established the fort around 1843 as a trading post. The fort also played an important role in the immigration of people to the west. Evidence of the original fort built by Bridger has been obliterated by other periods of construction, but it is thought to have been where the present fort is situated.

Transcontinental immigration trails to California followed a route north of the dunes and badlands in Sweetwater County. In the western portion of the southwestern coal region, where climatic conditions were more amenable, these trails turned south to avoid the mountainous regions of Utah. First named the Oregon Trail, later the California Trail, and even later the Mormon Trail, the route divides just prior to crossing the Green River. There are 104 miles of this trail in the ES region. Various crossings of the Green River were used; most notable in this region was the Lombard Ferry. About 20 miles of the Cherokee Trail, running northwest from Hiawatha Camp to Granger, also lies in the region. The Dempsey Cutoff (about 30 miles) in Lincoln County was used to shortcut the southward turn of the Oregon Trail. This later trail is sometimes called the Bridger Cutoff, and about 104 miles remain in the region. The trails mentioned above vary in preservation, some wheel ruts are still pronounced and quite visible, other segments have been obliterated by highway construction, towns, and railroads.

In the early 1860s, western migration began to subside, but a need for transcontinental communication kept the area active. The Pony Express, established in 1860, was the first regularly scheduled mail route through this country. The route followed the Oregon Trail and Bridger Cutoff. Later the Overland Stage was to follow this same route but, owing to Indian problems, was rerouted in 1862.

The Overland Stage route in the ES region has essentially the same corridor as Interstate 80. To keep fresh horses and provide passengers with suitable lodging during the transcontinental trip, the Overland Stage Company established stations at 15-mile intervals along its route. From east to west in the region they are Dug Springs, La Clede, Big Pond, Black Butte, Point of Rocks, Salt Wells, Rock Springs, Green River, Lonetree, Hams Fork, Church Buttes, Millersville, Fort Bridger, Muddy, Quaking Aspen or Alpine, and Bear River Stations. The Point of Rocks Station is partially reconstructed; others are completely destroyed or are in various stages of deterioration.

The Overland Stage lasted until the railroad was completed in 1869. During use of the Oregon and Overland Trails, the U.S. Army established outposts in the region to protect immigrants and later the stage route. Fort La Clede, Fort Bridger, and Fort Supply are in the region, and only Fort Bridger has undergone any extensive restoration.

The Settlement and Development period, 1869-1925, was brought about by completion of the railroad, and in fact much of the intensive settlement and development was railroad related. Coal mining to supply the trains became an important activity. The Gibraltar Mine and the Black Butte Mine were established to supply the Union Pacific Railroad (UPRR) with coal. Other coal discoveries at Kemmerer, Hallville, Point of Rocks, Superior, and Almy, to name a few, established the region's importance as a coal producer. At present most of these old mine buildings are in ruins.

In 1902, the Colorado and Wyoming Chemical Company acquired land near Green River, put down wells for the extraction of soda, and built a plant for the production of soda ash. This was a small start but is historically a predecessor of later more intensive development of this resource in the 1950s (Murray 1976).

Petroleum was first noted in the region by Stansbury in 1850. Small commercial operations began in the 1860s. The oil produced was used as wagon grease by immigrants and in the mines. Production of oil and gas continues in the region today.

Ranching and farming during the 1869-1925 period in this region began with "tent-camp"traders, who profitably exchanged rested, well-fed, draft-stock for trail-worn stock. William A. Carter, a settler to one of the units in the Utah Expedition, settled at Fort Bridger in 1857 and developed an extensive trading operation. In 1869, he brought purebred shorthorn bulls out from the east to upgrade his herds (Murray 1976). The coming of contract beef herds to feed UPRR construction workers probably accelerated the stocking of ranges in southwestern Wyoming. The decade of the 1870s saw a dramatic increase in numbers of cattle in Wyoming. By the late 1870s, railroads carried substantial shipments of cattle to eastern markets.

Hilliard, on the UPRR east of Evanston, was the scene of a significant lumbering facility which supported the UPRR and its mining subsidiaries. Here, the Hilliard Flume and Lumber Company built a 30-mile wooden flume system from the cuttings on Mill Creek to the plant at Hilliard where ties and lumber were cut. Thirty-six brick, charcoal kilns were also built to utilize scrap from the operator; known as the Piedmont Charcoal Kilns, they are on the National Register of Historic Places.

Freighting and stage lines often used the same trails and functioned through comparable time periods along them. With the coming of the railroad, stage and all significant east-west wagon freight traffic through the region ceased. The stage stations closed down as the railroad progressed, which made possible the development of feeder stagecoach lines for the railroad.

Table R2-9C summarizes some of the known historic sites in the area. These are compiled from the National Register of Historic Places, Wyoming's Historic Preservation Plan Inventory of Historic Sites, and from an historic resource study prepared for the BLM by Western Interpretive Service.

Table R2-9C

HISTORIC SITES IN THE SOUTHWESTERN WYOMING COAL ES REGION

	Site	County	Type	Condition
Period I--Fur Trade and Exploration (1812-1841)				
Wyoming Historic Inventory (Eligible for Nomination)	Browns Hole	Sweetwater	Locale	Good
	Burnt Fork Rendezvous	Sweetwater	Locale	Good
Known or Potential Sites	Bridger/Fraeb Post	Sweetwater	Locale/ buidling(?)	Post gone
Period II--Acquisition, Emigration, Transportation, Communication, and Early Military History (1842-1869)				
National Register Sites	Expedition Island	Sweetwater	Locale	Good
	Granger Stage Station	Sweetwater	Building	to be restored
	Point of Rocks Stage Station	Sweetwater	Building	Partially restored
	John Scout Rocks	Lincoln	Locale	Good
	Emigrant Springs	Lincoln	Locale	Good
	Fort Bridger	Uinta	Structure	Partially restored
Wyoming Historic Inventory (Eligible for Nomination)	Dug Springs Station	Sweetwater	Building	Deteriorated
	La Clede Station	Sweetwater	Building	Deteriorated
	Big Pond Station	Sweetwater	Building	Deteriorated
	Black Buttes Stage Station	Sweetwater	Building	Deteriorated
	Fort La Clede	Sweetwater	Building	Deteriorated
	Green River State Station	Sweetwater	Building	Deteriorated
	Lone Tree Stage Station	Sweetwater	Building	Deteriorated
	Oregon Trail	Sweetwater	Trail	Variable
	Overland Trail	Sweetwater	Trail	Variable

Table R2-9C

HISTORIC SITES IN THE SOUTHWESTERN WYOMING COAL ES REGION
(Continued)

	Site	County	Type	Condition
Period II (Continued)	Rock Springs Stage Station	Sweetwater	Building	Deteriorated
	Dempsey Cutoff	Sweetwater/ Lincoln	Trail	Variable
	Lombard Ferry	Sweetwater	Locale	Good
	Morman Ferry	Lincoln	Locale	Good
	Fontenelle Crossing	Lincoln	Locale	Good
	Nancy Hill Grave	Lincoln	Grave	Good
	Barrel Springs Station	Uinta	Building	Deteriorated
	Bear River Stage Station	Uinta	Building	Deteriorated
	Pony Express Station	Uinta	Building	Deteriorated
	Camp Scott	Uinta	Probable structure	Buried
	Carter Post Office	Uinta	Structure	Good
	Church Buttes Pony Express Station	Uinta	Structure	Deteriorated
	Fort Supply	Uinta	Structure	Some evidence
	Hilliard Stage Station	Uinta	Structure	Deteriorated
	Millersville Station	Uinta	Structure	Deteriorated
	Morman Sawmill	Uinta	Structure	Deteriorated
	Muddy Station, Pony Express	Uinta	Structure	Deteriorated
	Myers Ranch, Stage, Pony Express	Uinta	Structure	Deteriorated
	Oregon Trail	Uinta	Trail	Variable
	Overland Trail	Uinta	Trail	Variable
	Cherokee Trail	Sweetwater	Trail	Variable
	Quaking Aspen Station, Pony Express	Uinta	Structure	Deteriorated
	Robertson Cabin	Uinta	Structure	Unknown

Table R2-9C

HISTORIC SITES IN THE SOUTHWESTERN WYOMING COAL ES REGION
(Continued)

	Site	County	Type	Condition
Period II (Continued)				
Known and Potential	Rador Springs Stage Station	Sweetwater	Structure	Deteriorated
	Millburne Townsite	Uinta	Structure	Deteriorated
	Meek's Cabin	Uinta	Structure	Unknown
	Utah Expedition Camps	Uinta	Locale	Unknown
Period III--Settlement and Development Period 1869-1925				
National Register Sites	Fort Bridger	Uinta	Structure	Partially restored
	Peidmont Charcoal Kiln	Uinta	Structure	Partially restored
	J.C. Penny Home	Lincoln	Structure	Preserved
Wyoming Historic Inventory (Eligible for Nomination)	Bryan Townsite	Sweetwater	Structure	Deteriorated
	Dodge Suspension Bridge	Sweetwater	Locale	Deteriorated
	Superior Mines	Sweetwater	Structure	Deteriorated
	Winton Townsite	Sweetwater	Structure	Variable
	Almy Townsite	Uinta	Structure	Unknown
	Bear River City	Uinta	Structure	Unknown
	Cumberland Townsite	Lincoln	Structure	Deteriorated
	Kemmerer Coal Fields	Lincoln	Locale	Unknown
Known and Potential Sites	The Wells	Sweetwater	Structure	Unknown
	Stansbury Townsite	Sweetwater	Townsite	Variable
	Reliance Townsite	Sweetwater	Townsite	Variable
	Dines Townsite	Sweetwater	Mine site	Deteriorated
	Horseshoe Bend of Green River	Sweetwater	Old ranch	Unknown
	Hawley Ranch(?)	Sweetwater	Structure	Unknown

Table R2-9C

HISTORIC SITES IN THE SOUTHWESTERN WYOMING COAL ES REGION
(Continued)

	Site	County	Type	Condition
Period III (Continued)				
	Piedmont Townsite	Uinta	Townsite	Unknown
	Robertson Community	Uinta	Possible old ranch	Unknown
	Miller Toll Bridge	Lincoln	?	Unknown
	Opal Townsite	Lincoln	Ranch settlement	Deteriorated
	Beckwith Townsite	Lincoln	Structures	Unknown
	Glencoe Mine	Lincoln	Mine	Unknown
	Bon Rico Townsite	Lincoln	Structures	Unknown
	Glencoe Junction	Lincoln	Structure	Unknown
	Elkol Townsite	Lincoln	Structures	Deteriorated
	Hallville	Sweetwater	Town/mine structures	Deteriorated
	Gibraltar Mine	Sweetwater	Town/mine structures	Deteriorated
	Black Buttes Mine	Sweetwater	Mine structure	Deteriorated

The National Register lists a number of historical sites relating to this and earlier periods within the region. They include: Fort Bridger, Piedmont Charcoal Kilns, the J.C. Penney House, Emigrant Springs, Johnston Scout Rock, Names Hill, Parting of the Ways, Granger Station, Expedition Island, and Point of Rocks Stage Station.

Recent Wyoming history, since 1925, was a virtual low point in overall economic activity. Economic conditions remained uncomfortable through the depression years 1929-1939. Rising farm and ranch prices, with the opening of World War II, were coupled with an unprecedented demand for minerals, notably coal and petroleum. This brought a new wave of prosperity to major population centers in the region. The post-war era brought a continuation of the expanding market for mineral resources along with a good, if not always stable, agricultural situation.

Most of the major changes in recent times within the region have resulted from intensive development of mineral resources. Petroleum and natural gas continue and, in fact, have increased in importance in the region. Underground coal mining reached its peak during World War II at Winton, Superior, Dines, and Reliance, but many closed in the early 1950s with the railroad changeover to diesel power. A new coal market situation, created by a massive increase in industrial consumption of electric power nationally and within the region, and the introduction of large scale surface mining techniques have substantially changed Green River and Rock Springs.

For the most part it is difficult to sort out sites and structures of historic importance for the recent period. It is also difficult to single out representative examples of truly historic developments, since most of the really history making events and things of the period are still functional and still changing.

In the ES region there are numerous historic sites which are important to the peopling of western America. Although the condition of these sites varies considerably, and the relative significance of many later sites is yet unknown, their importance is not diminished.

VISUAL RESOURCES

The southwestern Wyoming ES region is composed of low mountains and semiarid basins with a variety of landscapes: rolling sage plains, badlands, river bottoms, juniper hills, isolated mountain timber stands, sand dunes, deep canyons, and altered landscapes, i.e., farmland, mining areas, urban centers, etc.

These landscapes have been classified under the Visual Resource Inventory and Evaluation System (BLM Manual 6310). The analysis from which these classes have been taken is available at the Rock Springs District Office of the BLM. Classes are delineated on the Visual Resource Management Classes Map (Map 10, Appendix A).

The region is represented by four Visual Resource Management (VRM) classes (Classes II, III, IV, and V) described below:

Class II—A river bottom (Figure R2-10A), composed of dense stands of cottonwood and willow with a variety of seasonal color, is one example of a VRM Class II area. Other examples are badlands, sand dunes, forested areas, and high use areas. Management would require that any changes caused by a management activity should not be evident in the characteristic landscape.

Class III—Juniper (Figure R2-10B) offer a variety of texture and color to the region with stands of a few trees to over 100,000 acres. Other examples of VRM Class III areas include areas along major roads where use volume is high and along fringes of Class II areas like Flaming Gorge Reservoir. Management would require that changes should remain subordinate to the visual strength of the existing landscape character.

Class IV—A major portion of the region is covered by rolling sage plains (Figure R2-10C) which usually offer little variety in visual character. However, the plains do provide various combinations of color in vegetation and soil due to changes in weather and season. Management would require that changes may be subordinate to the original composition and character but must reflect what could be a natural occurrence within the characteristic landscape.

Class V—Altered landscapes are often characterized by a variety of intrusions (Figure R2-10D). Change is needed; this class applies to areas where the naturalistic character has been disturbed to the point where rehabilitation is needed to bring it back into character with the surrounding countryside.

RECREATIONAL RESOURCES

Visitor Use Data

Local resident visitor use by recreational activity based on an estimated 1977 population of 59,916 for the region is shown in Table R2-11A. The data used to derive the visitor use estimates are available at the Rock Springs District Office of the BLM.

Fishing

Fishing is a major recreational activity in the region and occurs along streams and lakes which support trout. The areas that are used quite extensively by fishermen are the Flaming Gorge Reservoir, Fontenelle Reservoir, Viva Naughton Reservoir, Green River, Hams Fork, and Bear River. Fishing use in the region is one-half by out-of-state persons, one-quarter by local residents (see Table R2-11A), and one-quarter by other Wyoming residents.

Figure R2-10A

CLASS II--RIVER BOTTOM

Figure R2-10B

CLASS III--JUNIPER STANDS

Figure R2-10C

CLASS IV--ROLLING SAGEBRUSH PLAIN

Figure R2-10D

CLASS V--INTERSTATE 80 AND
OTHER INTRUSIONS

Table R2-11A

LOCAL RESIDENT VISITOR USE IN THE SOUTHWESTERN WYOMING REGION
BASED ON A 1977 ESTIMATED POPULATION OF 59,916

Activity	Visitor Days[1]
Fishing	250,300
General[2]	224,700
Hunting	79,100
Off-road vehicle[3]	9,800
Sightseeing	76,800
Urban	154,500
Water sports	115,500
Winter sports	31,200

[1]Visitor day consists of 12 hours.
[2]General includes camping, picnicking, etc.
[3]Estimate by ES team Outdoor Recreation Planner.

Hunting

Antelope hunting draws people to the southwestern Wyoming region from within the state and from other states. Other hunted animals are elk, deer, sage grouse, and cottontail rabbits. For distribution of these animals, see Map 8, Appendix A, Fish and Wildlife. One-quarter of the hunting use is by out-of-state persons, another one-quarter by local residents (Table R2-11A), and the other one-half by other residents of the state. Most of the local big-game hunters go outside the region to hunt elk and antelope because of the limited number of permits available in the region.

Sightseeing

Interstate 80 is a major route for recreationists traveling east and west. U.S. Highways 187 and 189 are the major routes toward Yellowstone and Teton National Parks which are north of the ES region (Map 11, Appendix A). Animals frequently seen from these routes are antelope, deer, elk, moose, wild horses, and golden eagles. The Overland Trail, Oregon Trail, and many other historic sites can be seen from these routes. Located within the region are the Wyoming Sand Dunes, the largest active dunes in North America.

Specialized Activities

Off-road vehicle (ORV) use is a major activity in the ES region. Approximately three-fourths of this use is by Wyoming residents with four-wheel drive vehicles, dune buggies, and snowmobiles. Nonresident use is by people coming to the area to work, hunt, or to attend the Fourth-of-July Dune Rally held 30 miles north of Rock Springs which is approximately 2 miles northwest of the proposed Long Canyon Mine. Fragile areas are being damaged around urban centers by high amounts of ORV use.

Existing Recreational Developments

The current recreation experience which can be expected in the region may be described as "primitive,"i.e., a person must rely on his own ingenuity for recreation.

Recreational opportunities include both man-made facilities and natural resources. Recreational facilities within the region are depicted on Table R2-11B. These facilities were developed by the federal government (BLM, U.S. Forest Service, and Bureau of Reclamation), county and city governments, and private owners. The Flaming Gorge National Recreation Area and Fossil Buttes National Monument draw many people to the region.

Potential Wilderness Study Areas

There are two areas in the region which are under consideration by the BLM as study areas owing to their primitive values pursuant to Section 603 of the Federal Land Policy and Management Act (FLPMA) of 1976. These two areas are Adobe Town and Red Creek Badlands. These areas are far enough away from the proposed mining that they would not be affected.

Prior to completion of the wilderness study as prescribed in Section 603 of FLPMA, the area of each site-specific development proposal would be inventoried for its wilderness and roadless characteristics and proper protective requirements would be incorporated into the authorization.

AGRICULTURE

Livestock Grazing

Rangelands of the ES region (approximately 6.3 million acres) provide year-round and seasonal grazing for livestock (cattle, sheep, and horses). (Grazing data derived from planning decisions and Management Framework Plans for the Salt Wells/Pilot Butte and Pioneer Trails Planning Units, Rock Springs District, BLM, 1977.) Approximately 54% of the rangelands are public and are used in conjunction with state and deeded rangelands.

The public rangelands provide approximately 357,000 animal unit months (AUMs) per year for livestock belonging to 281 livestock operators. Wasatch National Forest Lands provide 1,617 AUMs for cattle per year (personal communication, Chandler P. St. John, U.S. Department of Agriculture, Forest Service, June 1978). Deeded and state rangelands produce an estimated 304,000 AUMs annually (assuming range sites and condition classes are similar to public rangelands).

Fencing is generally limited within the region with cattle and horses often running in common in large grazing allotments and sheep being herded. (Approximately 3,200 wild horses graze within the region.)

Livestock water is provided by springs, wells, intermittant and ephemeral streams, and by reservoirs and dugouts. (Sheep make extensive use of snow as a water source.)

Farmlands

Native and alfalfa hay are produced on approximately 104,000 acres within the region. Approximately 3,000 acres of wheat, 3,300 acres of barley, and 600 acres of oats are grown. The production is used by livestock operations within the region except for limited quantities which are sold to other users in and out of the region.

Table R2-11B

RECREATIONAL FACILITIES WITHIN THE ES REGION

Facility	County	Number in County	PAOT[1]	Approximate Annual Visitor Day Capacity	Developed Acres
Campground	Sweetwater	10	1,340	165,500	66
	Uinta	2	383	53,500	27
Picnic facilities	Lincoln	3	200	28,800	219
	Sweetwater	15	435	63,000	95
	Uinta	2	217	43,600	43
Boat facilities	Lincoln	1	25	3,600	NA
	Sweetwater	5	510	24,100	NA
Golf courses	Lincoln	1	NA	NA	108
	Sweetwater	2 (1 under construction)	NA	NA	160
Parks and Playgrounds	Lincoln	9	NA	NA	26
	Sweetwater	33	NA	NA	94¼
	Uinta	3	NA	NA	11
Ski area	Uinta	1	250	NA	101

Source: Green River Basin Study 1975.

[1]PAOT = Capacity of people at one time.

NA = Not Available

Prime

An estimated 2,000 acres of prime farmland occur within the region. Prime farmland must meet certain soil criteria and have sufficient, dependable moisture, which, in the region, requires irrigation (personal communication, personnel of the U.S. Department of Agriculture, Soil Conservation Service, Rock Springs, Wyoming, April 1978).

Unique

Unique farmland is used for growing specialty crops such as citrus fruit and is not present in the region.

FOREST RESOURCES

No coal mining is planned in any areas where forest products are harvested.

MINERAL RESOURCES

More than 3,100 square miles of the Sweetwater-Kemmerer area are underlain by minable coal deposits. The total identified original coal resources in all categories is 20.7 billion short tons. Published data on coal resources are listed on Table R2-13A.

Original resources of the Kemmerer field are 2.3 billion tons of bituminous coal and 1.4 billion tons of subbituminous coal. As of 1960, 62.4 million tons of coal had been produced, which is less than 2% of the total identified resources of the field (Townsend 1960).

Original resource estimates of the Rock Springs coal field identified 13 billion tons of bituminous and 3.8 billion tons of subbituminous coal. Nearly 30,000 acres have been worked through more than 40 openings along the west flank, and nearly 5,000 acres have been worked through more than 25 openings on the east flank of the Rock Springs Uplift. The total production from the field to January 1955 was about 192 million tons (Yourston 1955). These figures represent about 3% of the geographical area and less than 1.5% of the total identified resources of the field.

A description of the areas containing economically minable coal can be reviewed at the Rock Springs District Office of the BLM.

Oil and gas and sodium production from the region point to the importance of the large reserves of these minerals. Sand and gravel deposits formed by stream action are scattered through the region. At some future date deposits of oil shale may become of economic importance.

TRANSPORTATION NETWORKS

The different transportation networks located throughout the southwestern Wyoming region are shown on Map 13, Appendix A.

Highways

Interstate 80 is the major traffic route which services the region for east and westbound traffic. This four-lane highway is used quite heavily by truck freight, recreationists passing through the region, and local traffic.

There are four primary state highways passing through the region: U.S. Highway 187, U.S. Highway 189, U.S. Highway 30, and Wyoming 89. These primary highways are wide two-lane roads designed primarily for moderate to heavy traffic.

There are fifteen secondary state highways in the region. These secondary highways are narrow two-lane roads designed for light vehicle traffic. These roads are generally winding with blinding dips which make passing difficult in some areas.

There are three secondary roads in the region which are not state highways. These roads are quite narrow two-lane roads which are poorly maintained. These secondary roads are designed for very light use and are generally characterized by winding areas, blinding dips, and chuck holes which make driving and passing hazardous.

County roads branching from the highways provide access throughout the region. These roads are usually wide one-lane dirt roads with turnouts. These roads also serve as truck routes to the many oil and gas fields scattered throughout the region. These roads are designed for very light use, and during periods of adverse weather, rain or snow, these roads may be closed.

In 1976 there were 52,500 vehicle license tabs sold in southwestern Wyoming.

Railroads

The Union Pacific Railroad is a major western carrier serving thirteen states. In the southwestern Wyoming region, the line divides with one route angling northwest through Idaho, Oregon, and Washington. This line has many branches serving the three states. The other route from western Wyoming passes through Ogden as it crosses Utah, then through Nevada and into California, terminating in Los Angeles (see Map 13A, Appendix A). There are also several spur lines off the main line which service the existing coal mines and trona mines.

Capacity for a given segment of track is greatly influenced by factors other than simple arithmetic train count. Factors such as grades, running speeds, congestion in the yards or terminals at segment end points, and the "mix"of hot trains, manifest trains, and unit trains, which vary in speed as well as operating characteristics, can alter typical capacities listed in Table R2-14A. Therefore capacities should not be considered absolute.

The two most important factors in determining traffic capacity along a given line segment are the number of tracks and type of signalization. Single and double track segments predominate throughout the system, with a few segments containing three lines. There are two basic types of signalization, automatic block signals (ABS) and centralized traffic control (CTC) (Union Pacific Railroad Company 1978).

Table R2-13A

IDENTIFIED ORIGINAL COAL RESOURCES IN THE SWEETWATER-KEMMERER AREA
(IN MILLIONS OF SHORT TONS)

	Bituminous	Subbituminous	Lignite	Strippable Resources
Hams Fork region:				
Evanston field	0[1]	314[1]	0	---[2]
Kemmerer field	2,284[1]	1,362[1]	0	1,000[2]
LaBarge field	0	1	0	---
Bear River field	---	---	---	---
Green River region:				
Rock Springs field	12,933[4]	3,830[4]	0	250[3]
Henry's Fork field	0	0[1]	0	0
Frewen field	0	---	---	0[5]
Vermillion Creek field	0	---	0	130[5]

[1]Berryhill et al. 1950--bituminous coal 14 inches, subbituminous coal 2.5 feet, under less than 3,000 feet overburden.

[2]Smith et al. 1972--200 feet of bituminous coal under less than 1,400 feet overburden.

[3]Smith et al. 1972--30-40 feet of subbituminous coal under less than 200 feet overburden.

[4]Root et al. 1973--bituminous coal 14 inches, subbituminous coal 2.5 feet, under less than 3,000 feet overburden.

[5]Roehler, Coal resources of the Chicken Creek SW quandrangle, in preparation--high sulfer subbituminous coal F10 feet, under less than 200 feet overburden.

Table R2-14A

ESTIMATED CAPACITIES OF IDENTIFIED LINE SEGMENTS

Segment	No. of Tracks	Signaling	Length (Miles)	Estimated Capacity (trains per day)	Current Traffic (trains per day)	Estimated % Capacity
Kansas City to Topeka	2	ABS	68	55-60	44	73%
Topeka to Gibbon	1	CTC	203	25-30		73%
	2	CTC	17	70-80	22	28%
Council Bluffs to Gibbon	2	ABS	176	55-60	34	57%
Gibbon to North Platte	2	ABS	100	55-60		88%
	2	CTC	8	70-80	53	66%
North Platte to Cheyenne	2	ABS	182	55-60		78%
	2	CTC	43	70-80	47	59%
Cheyenne to Hanna	3	CTC	35	100-115		44%
	2	CTC	108	70-80	51	64%
Hanna to Rawlins	2	CTC	40	70-80	45	56%
Rawlins to Green River	2	ABS	101	55-60		73%
	2	CTC	33	70-80	44	55%
Green River to Granger	2	CTC	30	70-80	40	50%
Granger to Kemmerer	1	CTC	40	25-30	13	43%
Kemmerer to McCammon	1	CTC	174	25-30	13	43%
McCammon to Pocatello	1	CTC	174	25-30	13	43%
Granger to Ogden	2	ABS	126	55-60		53%
	2	CTC	19	70-80	32	40%

Source: Union Pacific Railroad Company 1978.

SOCIOECONOMIC CONDITIONS

Population

The population of the ES region in 1977 was estimated to be 59,916 (Table R2-15A). This was a significant increase (75%) over the 1970 population of 34,173; it was the result of a sudden and massive upswing in economic activity, primarily in mining and power production. This rapid growth was most evident in Sweetwater County, where it reached "boom-town"proporations in 1973 and 1974. In 1977, Sweetwater County accounted for 68.9% (41,263 persons) of the ES region's total population and contained two of its largest communities (Rock Springs and Green River). More than 80% (48,071 persons) of the entire region's population resided in only four communities, Rock Springs, Green River, Kemmerer/Diamondville, and Evanston.

Table R2-15B presents several characteristics of the Southwestern Wyoming ES region's population. Two items are most noteworthy. The region has slightly more men than women. This is a trait common to both agricultural and rapidly developing areas, which are both the exact situation in the ES region. Developing areas especially reflect this condition, because construction jobs are man oriented and attract single and transitory men without families. The second important characteristic is the relatively large percentage of persons in the younger age groups (0 to 19 and 20 to 44). This is also a common characteristic of developing areas since construction and other hard-labor jobs are most likely filled by younger men.

Employment

Total employment in the ES region was estimated to be 28,118 in 1977 (Abt Associates 1978). As mentioned in the population section, the region has had a significant increase in economic activity since 1970. This came about primarily from a massive growth rate in the trona mining industry and the construction of two major power plants, one in Sweetwater County and one in Lincoln County. These events resulted in a rapid increase in job opportunities and caused a large in-migration of miners, construction workers, and their families. Consequently, total employment rose by nearly 81% (12,542 jobs) over 1970 figures (Abt Associates 1978 and U.S. Department of Commerce, Bureau of the Census 1970a). This was most evident in Sweetwater County where employment increased by almost 139% (11,415 jobs) between 1970 and 1977.

Table R2-15C shows 1977 estimated employment by sector for each county and the total ES region. The mining and construction sectors currently share 40% (11,129 jobs) of total employment in the region. Their portion is largest in Sweetwater County (49% or 9,633 jobs) and smallest in Uinta County (7.4% or 353 jobs). The trade and services sectors have also grown significantly, but they have not been able to keep pace with the basic industries. This has caused the ratio of local services to basic employment to fall from 1.06 in 1970 (Bickert, Browne, Coddington, and Associates 1975) to 0.75 in 1977 (THK Associates 1977). The result of this is inflationary pricing and a shortage of local goods and services compared to demand.

Unemployment rates within the ES region in 1977 (11 month averages) were 3.8% (618 persons) in Sweetwater County, 6.3% (302 persons) in Lincoln County, and 3.9% (156 persons) in Uinta County (Wyoming Employment Security Commission 1977). Regionally, the rate is approximately 4.2% (1,056 persons), which is about 2% less than the national rate. In recent years Sweetwater County's rate has consistently been the lowest in the region, while Lincoln County's has been the highest.

Income

Estimated total personal earned income in the southwestern Wyoming region in 1977 was $342.8 million (Table R2-15D). Earnings in Sweetwater County were significantly larger than the other two counties (75% greater or $258.4 million of the total), reflecting both its larger size and greater economic activity. The influence of the mining and construction sectors with their relatively high wages is shown in the disparity between the per capita incomes of Sweetwater and Lincoln Counties ($6,263 and $6,254, respectively) and that of Uinta County ($3,454). Uinta has been least affected by recent growth since most of the economic and industrial developments have occurred in the other two counties. An indicator of the high level of economic activity occurring in the ES region is average weekly earnings. In 1970, all three counties' earnings were below the national average of $164 per week (U.S. Department of Commerce, Bureau of Census 1971). In 1975, the reverse was generally true. The national average for 1975 was $158 per week (U.S. Department of Commerce 1975C), while Sweetwater and Lincoln Counties' averages were $235 and $192, respectively. Only Uinta County ($141) was below the national average.

Despite the relatively high income figures, especially in Sweetwater County, there are considerable disparities in earnings. One of the greatest sources of disparity exists between basic industry employees (mining and construction) and service sector employees. Approximately one-quarter of the Sweetwater County work force is employed in retail trade and services where wages are typically less than 40% of the wages earned in mining and construction (Dempsey 1975). These wage levels are often below national averages (in the case of service trades, 24% below). Workers in these categories have often been placed at a relatively greater disadvantage during the recent period of rapid growth, because they must compete in a highly inflated housing market with higher paid mining and construction workers. Twenty percent of the families in the county could be classed as low income (Dempsey 1975). These are persons who have not participated in the economic benefits associated

Table R2-15A

1977 POPULATION: SOUTHWESTERN WYOMING COAL ES REGION

	Estimated Population 1977
Sweetwater County	41,263
Rock Springs	25,996
Green River	12,502
Balance of county	2,765
Lincoln County	7,132
Kemmerer/Diamondville	3,655
Balance of county	3,477
Uinta County	11,521
Evanston	5,918
Lyman	2,392
Mountain View	677
Balance of county	2,534
Regional total	59,916

Source: Abt Associates 1978.

Table R2-15B

1977 POPULATION CHARACTERISTICS: SOUTHWESTERN WYOMING COAL ES REGION

	Sweetwater County	Lincoln County	Uinta County	Regional Totals
Age distribution[1] (%)				
0-19	36.2	38.1	35.4	36.3
20-44	36.5	30.8	34.4	35.4
45-64	20.5	21.4	21.1	20.7
65 or over	6.8	9.7	9.1	7.6
Sex[2] (%)				
Male	50.4	49.5	50.7	50.5
Female	49.6	50.5	49.3	49.5
Population density (persons per square mile[3])	3.91	1.67	5.62	3.55

[1] Wyoming Department of Economic Planning and Development (DEPAD) 1977.
[2] Wyoming Employment Security Commission 1975.
[3] Derived from Wyoming Department of Administration and Fiscal Control, 1977 (land area) and Abt Associates 1978 (population).

Table R2-15C

1977 ESTIMATED EMPLOYMENT: SOUTHWESTERN WYOMING COAL ES REGION

	Sweetwater County	Lincoln County	Uinta County	Regional Totals
Total Employment	19,653	3,670	4,795	28,118
Proprietors	1,081	800	815	2,696
Farm	116	269	325	710
Nonfarm	965	531	490	1,986
Wage and Salary	18,572	2,870	3,980	25,422
Farm	243	227	142	612
Nonfarm	18,329	2,643	3,838	24,810
Government	1,821	492	1,383	3,696
Private	16,508	2,151	2,455	21,114
Manufacturing	358	183	181	722
Mining	4,897	626	122	5,645
Construction	4,736	517	231	5,484
Transportation	1,167	210	507	1,884
Trade	2,930	351	925	4,206
Finance, insurance and real estate	217	40	73	330
Services	2,169	207	411	2,787
Other	34	17	5	56

Source: Abt Associates 1978.

Table R2-15D

1977 ESTIMATED INCOME: SOUTHWESTERN WYOMING COAL ES REGION

	Total Personal Earned Income[1] ($-Millions)	Per Capita Income[1]	Median Family Income[2]
Sweetwater County	$258.4	$6,263	$16,200
Lincoln County	44.6	6,252	13,800
Uinta County	39.8	3,454	13,300

[1]Abt Associates 1978.
[2]Sales and Marketing Management Magazine, July 25, 1977.

with recent growth and are relatively worse off currently than they were in 1970, before the inflationary spiral.

Infrastructure

Private Sector

Contract construction and mining are the most important industries in Sweetwater and Lincoln Counties. In 1974, these sectors accounted for 66% and 43% of total earnings in the respective counties (U.S. Department of Commerce, Bureau of Economic Analysis 1974). In contrast, government and transportation were the dominant sectors in Uinta County. Most of the ES region's economic activity is concentrated in four communities that serve as the retail and wholesale centers of the three counties. As shown on Table R2-15E, Rock Springs, Green River, and Evanston had 341 of the 403 retail establishments in their two respective counties in 1972. While data are not available for Kemmerer/Diamondville, it was clearly the retail center for southern Lincoln County. In 1977, total retail sales in the region were estimated at $162.6 million, with Sweetwater County capturing 68% ($110.2 million) of the total. Retail sales data for 1977 are not available for municipalities; however, 1972 data on Table R2-15E show the dominance of the region's major cities as listed above. Wholesale activity follows a similar pattern; total estimated 1977 sales in the region were $55.1 million, with Sweetwater County capturing over 72% ($39.9 million) of the market. Lincoln and Uinta Counties had 10% ($5.6 million) and 17% ($9.6 million) of the wholesale market, respectively. It should be pointed out, however, that many of the region's residents travel as far as Salt Lake City to make many of their major purchases, such as appliances and furniture. This is to take advantage of the wider selection of goods available in a large city and to pay less inflated prices for them.

Public Finance

The 1977 public finance characteristics of the ES region are shown on Table R2-15F. All local government units shown are meeting their operating expenditure requirements adequately. Recent growth has increased assessed valuation in the region, but it has also forced both county and community governments to expand their operating and capital investment spending to meet demands for public services. Where assessed valuation has increased most significantly, counties (Sweetwater and Lincoln) have been able to reduce the mill levy on it. Lincoln County has also been able to reduce its bonded indebtedness to zero. Sweetwater County, on the other hand, has had to increase its bonded indebtedness as have several communities including Kemmerer, which is within 90% of its debt limit.

Housing

Rapid population growth has made housing one of the most critical problems in the ES region. Adequate housing is in short supply, and the heavy demand for it has inflated prices considerably. Table R2-15G provides a summary of existing housing, by type, in the region. It is significant to note that of the housing identified 34% (4,756 units) is mobile homes. As in many other high growth areas, mobile homes have provided temporary substitutes for more permanent dwellings. The conditions frequently encountered in crowded and outlying trailer parks, where normal services are lacking, often result in detrimental human impacts including family disruptions and other social problems.

Education

The ES region encompasses six school districts: Sweetwater 01 and 02; Lincoln 01; and Uinta 01, 04, and 06. Total 1977 regional enrollment was 11,390 (Table R2-15H). All school districts are currently operating at or near capacity and share similar problems. The recent population expansion has, of course, increased enrollment, putting pressures on both the numbers of available classrooms and teachers. Pressures to expand facilities are greatest in Sweetwater Districts 01 and 02 and Lincoln 01, but these are also the areas with the higher assessed valuations. All three of these districts' assessed valuations per average daily membership are greater than the state average of $31,143 by a factor of 2 or 3. Most districts also have teacher recruiting problems that are aggravated by the housing shortage. Prospective teachers are frequently unable to find suitable housing and are deterred from relocating to the area. Student/ teacher ratios partially reflect this situation. Only one district (Lincoln 01) has a ratio surpassing the state's average of 18.4:1.

Health Care

One of the most serious areas of unmet public service needs throughout the ES region is health care. It has been identified by the Sweetwater County Priorities Board, in a 1975 survey of its membership, as the most important area of unmet needs. It is also significant to note that *Wyoming* Health *Profiles* (1976) listed six counties in the state as areas of scarcity in terms of available medical services. All three of the counties in the ES region were included in this category. They achieved this designation due to the fact that each has a high disparity between actual ratios of service to population and standard ratios across a number of categories including both personnel and physical facilities (Table R2-15I).

All three counties are critically short of doctors, which requires residents either to wait excessive periods before medical appointments or to go outside the region for services. It is not uncommon for residents to travel as far as Salt Lake City for the services of surgeons or specialists. Of the three counties, Sweetwater is obviously the most hard pressed; it is below state standards in all

Table R2-15E

RETAIL TRADE STATISTICS: SOUTHWESTERN WYOMING COAL ES REGION

	1972 Number of Establishments[1]	1972 Sales[1]	1977 Estimated Sales[2]
Sweetwater County	274	$61,104,000	$110,200,000
Rock Springs	179	47,008,000	NA
Green River	64	11,043,000	NA
Balance of county	31	3,053,000	NA
Lincoln County	145	16,109,000	17,300,000
Kemmerer/Diamondville	NA	NA	NA
Balance of county	NA	NA	NA
Uinta County	129	18,813,000	35,100,000
Evanston	98	15,282,000	NA
Balance of county	31	3,531,000	NA
Regional Totals	548	$96,026,000	$162,600,000

[1]U.S. Department of Commerce, Bureau of the Census 1972a.
[2]Abt Associates 1978.

NA = Not Available

Table R2-15F

1977 PUBLIC FINANCE CHARACTERISTICS: SOUTHWESTERN WYOMING COAL ES REGION

County Community	Assessed Valuation ($-millions)	Debt Limit ($-millions)[1]	Bonded Debt ($-millions)[1]	Total Operating Expenditures ($-millions)	Total Revenues ($-millions)	Surplus Revenues Beginning of FY 1977
Sweetwater County	469.9[2]	9.40	4.65[6]	4.05[7]	4.62[7]	836,078
Rock Springs	29.3[3]	2.30	0.21[6]	7.98[8]	10.27[8]	4,244,520
Green River	14.6[3]	1.20	0.44[6]	4.47[9]	2.80[9]	603,650
Lincoln County	116.1[2]	2.30	0[6]	1.40[10]	1.25[10]	478,700
Kemmerer	4.1[4]	0.33	0.30[6]	NA	0.7[16]	NA
Diamondville	1.1[4]	0.09	0.02[6]	0.09[11]	0.1[11]	22,125[11]
Uinta County	31.6[2]	0.60	0.95[6]	0.74[12]	0.75[12]	317,483
Evanston	7.6[5]	0.60	1.63[6]	0.86[13]	1.10[13]	71,546[13]
Lyman	1.5[5]	0.12	0.25[6]	0.47[14]	0.52[14]	68,847[14]
Mountain View	0.7[5]	0.06	0[6]	0.08[15]	0.08[15]	NA

[1]Counties have a 2% of assessed valuation bonding limit. Municipalities have an 8% of assessed valuation bonding limit with an additional 4% for sewer projects and no limit on bonded debt for water projects.
[2]Wyoming Taxpayers Association, Wyoming Property Tax Rates, 1977, Table D (Yellow).
[3]Ibid., Sweetwater County Detail.
[4]Ibid., Lincoln County Detail.
[5]Ibid., Uinta County Detail.
[6]State Examiners Bonded Indebtedness Report, 1977.
[7]Sweetwater County General Fund Budget 1977.
[8]City of Rock Springs, Final Budget, 1977-78 Operating Budget (includes capital costs).
[9]Green River City Clerk, 1977 expenditures.
[10]Lincoln County Budget Abstracts.
[11]Clerk-Treasurer Report to State Examiner, 1/16/78 and 7/20/77.
[12]Uinta County Budget Message, FY '78, General Fund Expenses for 1977.
[13]City of Evanston, Annual Financial Statement, June 3, 1977, 1977 expenditures.
[14]Lyman, FY '78 Budget, 1977 expenditures.
[15]Mountain View 1977 Budget Submitted (FY '77 General Fund Budget).
[16]Interview with Kemmerer City Clerk.

NA = Not Available

Table R2-15G

HOUSING CHARACTERISTICS: SOUTHWESTERN WYOMING ES REGION

County Community	Total Units	Single-Family	Multi-Family	Mobile Homes
Sweetwater County[1]	10,367	5,555	1,171	3,641
Rock Springs[1]	5,197	3,199	622	1,376
Green River[2]	3,312	1,783	467	1,062
Balance of county	1,858	573	82	1,203
Lincoln County[3]	NA	NA	NA	NA
Kemmerer/ Diamondville	1,444	729	303	412
Balance of county	NA	NA	NA	NA
Uinta County[3]	NA	NA	NA	NA
Evanston	1,568	1,064	198	306
Lyman	507	196	13	298
Mountain View	219	120	0	99
Balance of county	NA	NA	NA	NA

[1]Abt Associates 1978.
[2]THK Associates 1976.
[3]Lincoln/Uinta Association of Governments 1977.

NA = Not Available

Table R2-15H

1977 EDUCATION SYSTEM CHARACTERISTICS: SOUTHWESTERN WYOMING COAL ES REGION

	Sweetwater County		Lincoln County		Uinta County		Regional Totals
	Rock Springs SD#1	Green River SD#2	Kemmerer SD#1	Evanston SD#1	Lyman SD#6	Mountain View SD#4	
1977 fall enrollment[1]	4,903	3,052	912	1,249	677	597	11,390
Number of classroom teachers (full-time equivalent)[1]	259.5	145.0	50.5	60.0	33.5	32.0	580.5
Student/teacher ratios[1,3]	18.9	21.0	18.1	20.8	20.2	18.7	N/A
Total annual expenditures ($-millions)[1]	11.08	5.37	1.66	1.75	1.2	0.92	21.98
Average daily membership (ADM)	4,557	2,875	922	1,218	661	572	10,805
Expenditures per ADM[2,4] ($)	2,429	1,857	1,681	1,461	1,664	1,713	N/A
Assessed valuation ($-millions)[1]	313.0	134.5	59.0	17.2	7.1	7.2	538.0
Assessed valuation Per ADM[2,5] ($)	68,686	46,783	63,991	14,122	10,893	12,483	N/A
Number of classrooms[1]	222	139	44	58	35	30	528

[1]Wyoming Department of Education, Division of Planning, Evaluation, and Information Services, 1977.

[2]Derived from Wyoming Department of Education data.

[3]Fall 1977 statewide average for classroom teachers - 18.4 (Wyoming Department of Education, Division of Planning, Evaluation, and Information Services, 1978).

[4]1976-1977 statewide average expenditures per ADM - $1,721 (Wyoming Department of Education, Division of Planning, Evaluation, and Information Services, 1978).

[5]1976-1977 statewide average assessed valuation per ADM - $31,143 (Wyoming Department of Education, Division of Planning, Evaluation, and Information Services, 1978).

N/A = Not Applicable.

Table R2-15I

HEALTH AND SOCIAL SERVICES: SOUTHWESTERN WYOMING COAL ES REGION

Personnel Facilities	Sweetwater County Number[1]	Sweetwater County Ratio Per Population Increment	Lincoln County Number[2]	Lincoln County Ratio Per Population Increment	Uinta County Number[3]	Uinta County Ratio Per Population Increment	State Standard Ratio Per Population Increment[1]
Physicians	14	1:2,947	3	1:2,377	4	1:2,880	1:1,000
Nurses (employed)							
Registered nurses	92	1:449	9	1:792	10	1:1,152	1:285
Licensed practical nurses	24	1:1,719	5	1:1,426	4	1:2,880	1:769
Public health nurses	8	1:5,158	1	1:7,132	1	1:11,521	1:7,660
Total	124		15		15		
Dentists	13	1:3,174	3	1:2,377	3	1:3,840	1:1,600
Optometrists	5	1:8,253	1	1:7,132	2	1:5,761	1:7,000
Hospitals	1	1:41,263	1	1:7,132	1[4]	1:11,521	1:19,944
Hospital beds	97	1:425	20	1:357	22	1:524	1:179
Ambulances	9	1:4,585	5	1:1,426	5	1:2,304	1:3,740
Emergency rooms	1	1:41,263	1	1:7,132	1	1:11,151	1:13,296
Mental health centers	1	1:41,263	1	1:7,132	1	1:11,151	1:12,397

[1]Wyoming Division of Health and Medical Services, 1977.

[2]Interview with Dr. Gayle Robinson, Administrator, South Lincoln Hospital, Kemmerer, January 1978.

[3]Interview with Ms. Mary Emerson, Acting Administrator, Uinta Memorial Hospital, January 1978.

[4]Excluding Wyoming State Hospital, Evanston.

categories shown on Table R2-15I except public health nurses. While Lincoln and Uinta Counties appear better off, it should be noted that the shortage of physicians negates otherwise acceptable service ratios. For instance, both of these counties have acceptable ratios for hospitals, but they lack the doctors to man them.

Mental Health Care

Mental health services for Lincoln and Uinta Counties are provided by the Jackson-based Western Wyoming Mental Health Association. Sweetwater County residents are served by the Southwest Counseling Service in Rock Springs.

Mental health problems associated with the recent boom have been most evident in an institutional setting at the Sublette County Treatment Center in Pinedale, an alcohol and drug abuse treatment facility serving the entire state of Wyoming. The facility has been in operation less than 2 years and has received a disproportionate number of clients from communities experiencing energy-related rapid growth, particularly Sweetwater County (Interview with Director, Sublette County Treatment Center, 26 November 1976).

Social Services and Income Assistance

Social Services. The primary provider of social services in Lincoln and Uinta Counties is the Wyoming Department of Health and Social Services, Division of Public Assistance and Social Services (DPASS). There is a county-maintained child development center at the Burgoon School in Diamondville. The Kemmerer Senior Citizens' Center offers information and referral services, transportation, escort, nutrition, health, recreation, and education. The DPASS staff in Uinta County is adequate for current needs, although the staff in Lincoln County have asked for additional personnel to handle child abuse cases.

The Sweetwater County Welfare Office provides social services and counseling to its residents. The total staff size of the office is seventeen. Though the agency has approximately the same number of social workers now as in 1971, case loads have risen by approximately one-third, according to welfare personnel. Much of this increase has been caused by a sharp rise in child neglect and abuse cases. According to the Wyoming Department of Health and Social Services, there are six certified day care centers in Sweetwater County—tow in Greein River and four in Rock Springs. There are two senior citizens' centers in the county—one in Rock Springs and one in Green River. Services offered include referral, outreach, transportation (though not on a regular basis), escort, nutrition, health, education, and recreation (Abt Associates 1977).

Income Assistance. Public assistance payments are the other major type of help offered by state and federal agencies in Lincoln, Uinta, and Sweetwater Counties. DPASS administers income supplements under the categories of Aid to Families with Dependent Children (AFDC), General Assistance, Emergency Assistance, and Food Stamps. In FY 1977, Sweetwater County had seven social workers to handle all public assistance services including nearly 1,500 AFDC cases. Lincoln and Uinta Counties had one social worker each, with AFDC cases of approximately 500.

Law Enforcement

Criminal Activity. Available data indicate that crime in the region has increased in recent years. County data for 1973, 1974, and 1975 show increases in categories of aggravated assault, burglary, drug offenses, public drunkeness, miscellaneous assult, and prostitution ("Wyoming Comprehensive Law Enforcement Plan"1973, 1974, and 1975). The Evanston police chief states that crime is increasing in the following areas: breach of peace, public intoxication, fights and assaults, vandalism, and burglaries. Much of the increase, particularly assaults and liquor-related crimes, involves transients, construction-related workers, and the unemployed (Evanston Police Chief 1976). Rock Springs' growth in population has carried with it a somewhat more than proportional increase in annual arrest, climbing to 3,518 in 1975 (Edmonds 1976). In Green River and Kemmerer there have also been serious increases in crime in recent years.

Law Enforcement Personnel and Facilities. Each county in the ES region is served by a sheriff's department. Sweetwater County's department has seventeen full time and seven part-time deputies. Personnel, equipment, and facilities are considered adequate. Lincoln County (sixteen full-time deputies) and Uinta County (six full-time deputies) both have shortages of personnel and equipment to meet their current needs. Nearly all municipal police forces presently face personnel and equipment shortages (Abt Associates 1978).

Court Systems. The entire ES region is served by the Wyoming Third Judicial District Court with one judge. Each county has a separate court system with four judges in Sweetwater, three in Lincoln, and one in Uinta. Most communities also provide municipal courts. All three levels of courts are generally developing case backlogs and are in need of additional judges, personnel, and adequate facilities. Specific information on courts and law enforcement agencies is available for review at the Rock Springs District Office of the BLM.

Fire Protection

Fire protection services in the region are generally provided by volunteer departments. Rural, unincorporated areas are typically served by county facilities and personnel located in major population centers. The quality and adequacy of equipment, facilities, and personnel vary considerably throughout the region.

Sweetwater County. Rock Springs is serviced by 23 paid and 3 volunteer firemen. Outlying areas within a 6-mile radius are also served by the force. Rock Springs

has a fire insurance rating of 7 (Wyoming Department of Economic Planning and Development (DEPAD) 1976a). The town of Green River has a 31-man volunteer fire department. Outlying areas within a 5-mile radius are also served by the department. The town has a fire insurance rating of 7 (DEPAD 1976a).

Uinta County. Evanston has one of the best volunteer fire departments in the state, with a Class 6 insurance rating (highest possible for a volunteer force). It has 39 volunteer personnel. Lyman, Mountain View, and Fort Bridger all have inadequate fire protection. Lyman must also serve outlying areas within a 6-mile radius; its water pressure is inadequate for fire protection purposes. Mountain View has an insurance rating of 10 (the lowest possible) because of inadequate equipment and water supply (DEPAD 1976a).

Lincoln County. Kemmerer's 24-person fire department serves all of southern Lincoln County. Kemmerer has an insurance rating of 8, which indicates an organized fire department with deficiencies in the fire department and water supply (DEPAD 1976a). Specific information on fire departments including equipment, facilities, and fire flows is available for review at the Rock Springs District Office of the BLM.

Sewer and Water Systems

Each community in the region operates its own waste water treatment facility. In all but one community (Green River), sewage collection systems are presently adequate; however, treatment problems exist in Kemmerer, Evanston, and Green River. Water supply in the region is a municipal responsibility except in Rock Springs and Green River where the Pacific Power and Light Company provides water services. Although the size and capacity of treatment systems vary, all communities share the problem of inadequate distribution systems. All communities recognize the limitations of their current systems and have plans for improvements. Specific information on sewer and water systems is available for review at the Rock Springs District Office of the BLM.

Utilities

Telephone, electricity, and natural gas systems throughout the region are considered adequate. In all cases they are operating within their capacities, and company officials foresee no major difficulties in providing needed services (Abt Associates 1978).

Attitudes and Expectations

The current attitudes of residents of these three counties, as determined by discussions with local officials, are similar in some respects and different in others, reflecting recent contrasting patterns of growth and change.

Having recently experienced a rapid and disruptive period of growth, Sweetwater County residents have apparently adjusted to fundamental changes in the attributes of their surroundings. Opposition to expansion, development of public services, adoption of land use controls, and other government action to control growth has given way to acceptance of growth and public sector involvement in controlling it (Abt Associates 1977).

These attitudes are not entirely shared by Lincoln and Uinta County residents. In both counties, residents and municipal public officials retain a traditional skepticism of the benefits of government intervention and a desire to remain independent; neither of these traditional points of view has been challenged by major economic or social disruptions (Warren and Warder 1978).

Kemmerer (Lincoln County) and Evanston (Uinta County) attitudes also differ in regard to community confidence in local public leadership. In Evanston, residents are relatively confident that their locally elected officials can deal with inevitable growth problems. Kemmerer residents apparently don't share similar confidence, perhaps because community growth and the response to growth have historically been more under the influence of the dominant coal mining firm in the county (Abt Associates 1977).

Among the region's three counties, attitudes toward recent (or anticipated) growth contrast among major demographic strata of the population. Newcomer and established resident differences often contribute to social tensions; newcomers typically share in direct economic benefits while established residents share less in the economic benefits and must adjust to the social costs borne of change in their communities. The local business community generally favors growth. Local elected officials tend to take a balanced view toward growth and change. On the one hand, they can benefit politically from growth; on the other hand, they are challenged by the problems associated with growth (and are typically blamed for any inadequate response). Social service providers and other public employees are often not in favor of growth, simply because they are the first group to experience the difficulties of accomplishing a constructive public sector response. The elderly, as well as individuals on fixed incomes, and others whose economic benefits are not tied to expansion in basic (mining and construction) industries are often against growth and change, simply because their relative economic status declines as housing, retail, service, and public sectors respond to increased demands by raising prices and taxes (Abt Associates 1977).

Life Styles

In the southwestern Wyoming region, the quality of life in Sweetwater County has undergone the most dramatic change in recent years. The rapid growth of Rock Springs and Green River has significantly affected the small-town atmosphere of these communities. The relatively quiet pace of life has given way to new patterns of economic and social activity. Increased noise, traffic congestion (along with more frequent minor violations and accidents), higher prices, and higher crime rates are the

types of inevitable problems that accompany the benefits of economic growth. Moreover, the county and these high-growth communities have only recently been able to "catch up"with this growth. A lagging service sector response to basic industry growth, housing demand that far exceeded supply, and inability of government to keep pace with public service demands contributed to a general decline in quality of county and community life over the past few years (Abt Associates 1977).

Neither Lincoln County nor Uinta County has experienced the same degree of economic and social disruption. Naughton Power Plant construction contributed to recent rapid growth and adjustment problems in Lincoln County, and the decision of an expanding Sweetwater County trona-mining workforce to live in Uinta County have contribed to rapid growth in the Bridger Valley. However, while there are some communities in each county (Diamondville and Lyman, for instance) where economic growth and social problems combine to negatively impact quality of life, neither the magnitude nor the pervasiveness of these changes is as dramatic as in Sweetwater County. In fact, the Lincoln and Uinta County seats (Kemmerer and Evanston, respectively) have experienced quite moderate changes in the pace and quality of community life (Abt Associates 1977).

FUTURE ENVIRONMENT

The most visible changes in the region by 1990 will probably be due to increased population. The additional development of coal, oil, gas, uranium, and trona resources; the expansion of two existing power plants; and certain major public works projects will offer increased employment opportunities and cause an increase in the region's population.

It is estimated that regional employment will increase by 29% from 1977 to 1990. This would be an increase from 28,118 jobs in 1977 to 30,834 in 1980, 34,295 in 1985, and 36,313 in 1990. Approximately 95% (7,793) of the new jobs by 1990 will be in Sweetwater County. Personal earned income will increase 88% from the estimated 1977 figure of $342.8 million to $416.5 million in 1980, $535.8 million in 1985, and $644.9 million in 1990. Due to the high percentage of new jobs created in Sweetwater County, much of the region's population growth will occur in the county and will center around the towns of Rock Springs and Green River. The region's population will increase 28%, from an estimated 59,916 persons in 1977 to 65,500 in 1980, 72,285 in 1985, and 76,654 in 1990.

Increases in population will place additional demands upon private and public services. Without significant advances in planning and construction, housing shortages will continue to be a regional problem. Inflated prices will also be a burden upon residents until services catch up with demand.

Although the basic life styles of people in the region should not change significantly, urban areas will increase in size, become more congested, and lose some of their small-town atmospheres.

Additional people in the region will result in increases in: (1) travel on primary and secondary roads (vehicle license tab sales will increase 33% from 52,500 in 1976 to 59,600, 65,800, and 69,700 in 1980, 1985, and 1990, respectively), (2) demand for outdoor recreation (Table R2F-1), (3) conflicts for land uses (e.g., outdoor recreationists vs. agricultural interests), (4) water withdrawal (Table R2F-2) and water developments, (5) vandalism and losses of cultural and paleontological resources, (6) vandalism of livestock range improvements, (7) rail traffic (Table R2F-3), (8) relative train emissions (Table R2F-4), (9) noise corridors (Table R2F-5), and (10) land disturbance (see Table R1-6).

Activities other than the proposed actions (see Table R1-6) will result in about 0.8% of the region's surface acreage being disturbed by 1990 (49,235 acres of 6.3 million acres) and will cause decreases in: (1) wildlife habitat and wildlife numbers (Table R2F-6), (2) the qualities of visual resources (planned livestock range improvements and increased off-road vehicle activities would also impact visual resources), (3) livestock carrying capacity (although regional livestock numbers will not be appreciably affected due to generally ongoing reclamation activities and the small percentage of regional disturbance), (4) soil productivity and vegetative production, (5) air quality, only appreciably at localized sites (Table R2F-7), and (6) mineral resources (Table R2F-8).

Surface mining on about 5,252 acres by 1990 will alter the topography and geology of the areas affected. Cultural and paleontological resources will be beneficially and adversely affected (see Geology and Cultural Resources sections, Chapter 4, for kinds of impacts) by the activities shown in Table R1-6. There is no reason to believe that the region's climate will differ in 1990 from the present.

Table R2F-1

RESIDENT VISITOR USE DEMAND FOR THE SOUTHWESTERN WYOMING REGION BASED ON ESTIMATED POPULATIONS OF 59,916 FOR 1977, 65,501, FOR 1980, 72,285 FOR 1985, AND 76,654 FOR 1990

Activity	1977 Visitor Days	1980 Visitor Days	1985 Visitor Days	1990 Visitor Days
Fishing	250,300	278,500	313,100	335,500
General[1]	224,700	273,000	312,700	339,300
Hunting	79,100	85,900	94,300	99,400
Off-road vehicles[2]	9,800	10,700	11,800	12,500
Sightseeing	76,800	84,200	95,400	102,600
Urban	154,500	178,100	215,100	239,300
Water sports	115,500	130,900	153,600	168,800
Winter sports	31,200	36,600	46,200	52,000

Note: Visitor day consists of 12 hours.

[1] General includes camping, picnicking, etc.
[2] Estimates by coal ES team Outdoor Recreation Planner.

NA - Not Available

Table R2F-2

ESTIMATED WATER WITHDRAWAL IN 1980, 1985, AND 1990
WITHOUT THE PROPOSED ACTIONS
(IN ACRE-FEET)

	1980	1985	1990
Public supplies			
Domestic	10,900	11,600	11,800
Commercial and industrial	6,640	7,100	7,170
Rural use			
Domestic	910	969	976
Livestock	4,780	4,780	4,780
Irrigation	1,210,000	1,210,000	1,210,000
Industrial, self-supplied			
Coal mining	665	806	806
Trona mining	119,000	119,000	119,000
Thermal-electric power plants	48,800	56,500	56,600
Total	1,401,695	1,410,755	1,411,132

Table R2F-3

ESTIMATED FUTURE RAILROAD TRAFFIC WITHOUT COAL MINING IN SOUTHWEST WYOMING

Segment	Estimated Capacity[1] (trains per day)	Current Traffic[1,2] (trians per day)	1980 Traffic[3,4] (trains per day)	1980 % Capacity	1985 Traffic[3,4] (trains per day)	1985 % Capacity	1990 Traffic[3,4] (trains per day)	1990 % Capacity
Kansas City to Topeka	70-80	44	48	60	56	70	65	81
Topeka to Gibbon	70-80	22	24	30	28	35	32	40
Council Bluffs to Gibbon	55-60	34	37	62	43	72	50	83
Gibbon to North Platte	70-80	53	58	73	67	84	78	98
North Platte to Cheyenne	70-80	47	51	64	60	75	69	86
Cheyenne to Hanna	70-80	51	56	70	65	81	75	94
Hanna to Rawlins	70-80	45	49	61	57	71	66	83
Rawlins to Green River	70-80	44	48	60	56	70	65	81
Green River to Granger	70-80	40	44	55	51	64	59	74
Granger to Kemmerer	25-30	13	14	47	16	53	19	63
Kemmerer to McCammon	25-30	13	14	47	16	53	19	63
McCammon to Pocatello	25-30	13	14	47	16	53	19	63
Granger to Ogden	55-60	32	35	58	41	68	47	78

[1]Union Pacific Railroad Company 1978.
[2]Through freight only.
[3]Abt Associates 1978.
[4]Estimates by ES team.

Table R2F-4

TOTAL TRAIN EMISSIONS: SOUTHWESTERN WYOMING ES REGION WITHOUT THE PROPOSED ACTIONS
Relative Impacts

Routes	1977 Existing Conditions	1980 Relative Projection	1980 Cumulative Impact	1985 Relative Projection	1985 Cumulative Impact	1990 Relative Projection	1990 Cumulative Impact
Kemmerer-Idaho border	1.00	1.05	.05	1.10	.10	1.30	.30
Granger-Kemmerer	1.00	1.00	.00	1.07	.07	1.14	.14
Granger-Utah border	1.00	1.04	.04	1.08	.08	1.14	.14
Granger-Green River	1.00	1.03	.03	1.08	.08	1.14	.14
Green River-eastern border of ES region	1.00	1.03	.03	1.08	.08	1.13	.13
Rock Springs-north	1.00	1.00	.00	1.50	.50	1.50	.50
Kemmerer-south	1.00	1.00	.00	1.00	.00	1.00	.00

Source: Abt Associates 1978.

Note: Relative impacts must be analyzed since absolute current air quality levels are not known. Also, using a common standard (e.g., lb./mile) is the most appropriate measure for comparing impacts on rail segments with different lengths and differing current levels of existing traffic.

Table R2F-5

NOISE CORRIDORS AND ACRES OF AFFECTED PROPERTY WITHIN MAJOR COMMUNITIES WITHOUT THE PROPOSED ACTIONS: SOUTHWESTERN WYOMING ES REGION

Communities	1977 Feet/ Acres	1980 Projection	1980 Cumulative Impact	1985 Projection	1985 Cumulative Impact	1990 Projection	1990 Cumulative Impact
Rock Springs							
North spur							
Width of noise corridor	876 ft.	876 ft.	0	1,100 ft.	224 ft.	1,100 ft.	224 ft.
Total acres involved	340 ac.	340 ac.	0	427 ac.	87 ac.	427 ac.	87 ac.
Main line							
Width of noise corridor	4,056 ft.	4,056 ft.	40 ft.	4,200 ft.	146 ft.	4,236 ft.	180 ft.
Total acres involved	3,445 ac.	3,479 ac.	34 ac.	3,567 ac.	122 ac.	3,598 ac.	153 ac.
Green River							
Width of noise corridor	4,128 ft.	4,200 ft.	72 ft.	1,252 ft.	124 ft.	4,292 ft.	164 ft.
Total acres involved	910 ac.	926 ac.	16 ac.	940 ac.	30 ac.	946 ac.	36 ac.
Kemmerer							
Width of noise corridor	2,876 ft.	2,926 ft.	50 ft.	2,962 ft.	86 ft.	3,138 ft.	262 ft.
Total acres involved	1,080 ac.	1,099 ac.	19 ac.	1,112 ac.	32 ac.	1,178 ac.	98 ac.
Evanston							
Width of noise corridor	3,650 ft.	3,700 ft.	50 ft.	3,762 ft.	112 ft.	3,840 ft.	190 ft.
Total acres involved	1,130 ac.	1,148 ac.	18 ac.	1,167 ac.	37 ac.	1,192 ac.	59 ac.

Source: Abt Associates 1978.

Table R2F-6

ESTIMATED NUMBERS OF WILDLIFE LOST DUE TO ACTIVITIES (SEE TABLE R1-6)
OTHER THAN THE PROPOSED ACTION (INCLUDING PROGENY)

Kind of Wildlife	1980	1985	1990	Percent of Regions Production Lost by 1990
Small nongame birds	45,000	230,000	340,000	<0.1
Sage grouse	500	2,700	4,000	0.5
Small nongame mammals	2.23 million	11.5 million	16 million	<0.1
Antelope	300	900	1,400	2
Deer	250	800	1,300	1
Reptiles and amphibians	37,000	184,000	271,000	<0.1
Wild horses[1]				

[1]Wild horses will not be significantly impacted, because the BLM plans to reduce horse numbers within the region.

Table R2F-7

AIR QUALITY CHANGES FROM 1975 LEVELS DUE TO ACTIVITIES OTHER THAN THE PROPOSED ACTIONS

Location	Activity	Total Suspended Particulates (TSP) Change in Annual Emission Tons/Year	Total Suspended Particulates (TSP) Percent Change From 1975 Levels	Sulfur Dioxide (SO_2) Change in Annual Emission Tons/Year	Sulfur Dioxide (SO_2) Percent Change From 1975 Levels	Nitrogen Oxide NO_x Change in Annual Emission Tons/Year	Nitrogen Oxide NO_x Percent Change From 1975 Levels
Allied Chemical Plant	Expansion	+657	+46	N/A	N/A	N/A	N/A
Jim Bridger Plant	Expansion	+1424	+5	-41,610	-63[1]	3,514	+33
Naughton Power Plant	Expansion	+1148	+20	+4792	+ 5	7,280	+68
Rock Springs	Increased traffic and construction	+[2]	+	+	+	+	+

[1] By 1985 the retrofitting of earlier units 1, 2, 3 with scrubbers will reduce overall SO_2 emissions.

[2] Increases predicted but quantification not available.

N/A = Not Applicable.

Table R2F-8

CUMULATIVE DEPLETION OF REGIONAL MINERAL RESOURCES

Resource	1980	1985	1990
Coal	45MM Tons	69MM Tons	194MM Tons
Oil and gas	+1	+	+
Uranium	0	+1	+
Sodium	+1	+	+
Sand and gravel	41,000 $Yd.^3$	66,000 $Yd.^3$	66,900 $Yd.^3$
Clinker (scoria)	133,800 $Yd.^3$	166,800 $Yd.^3$	166,800 $Yd.^3$

[1]Depletion would continue to the extent of future market demands (quantitive data are unavailable).

CHAPTER 3

PLANNING AND ENVIRONMENTAL CONTROLS

This chapter presents the planning and environmental controls under which the proposed coal mines would be required to operate if approved.

The chapter is in three sections: (1) listing of principal planning and environmental legislation and regulations which control federal, state, and (or) local government action with their respective applications to coal development, (2) a discussion of land use plans, controls, and constraints, and (3) a summary discussion of institutional relationships.

FEDERAL COAL LEASING AND MANAGEMENT ARE CARRIED OUT UNDER THE FOLLOWING LAWS, REGULATIONS, AND POLICY GUIDANCE

Two laws that provide the basic authorities for leasing of federal minerals, including coal, are: Mineral Leasing Act (41 Stat. 437, as amended; 30 U.S.C. 181 et seq.) and Mineral Leasing Act for Acquired Lands (61 Stat. 913; 30 U.S.C. 351-359).

The law that provides the basis for public land and resource management is the Federal Land Policy and Management Act (FLPMA) of 1976 (90 Stat. 2743; 43 U.S.C. 1701-1771).

These laws are implemented by the Bureau of Land Management (BLM) and the Geological Survey (USGS) under the following regulations:

Title 43 Code of Federal Regulation (CFR) Part 3041 provides procedures to ensure that adequate measures are taken during exploration or surface mining of the federal coal (among other minerals) to avoid, minimize, or correct damages to the environment (land, water, and air) and to avoid, minimize, or correct hazards to public health and safety. This provides the basis for the technical examination as well as evaluation of proposed mining and reclamation plans.

Title 43 CFR Part 3500 provides procedures for leasing and subsequent management of federal coal (among other minerals) deposits.

Title 43 CFR Part 2800 establishes procedures for issuing rights-of-way to private individuals and (or) companies on public lands.

Title 30 CFR Part 211 governs operations for discovery, testing, development, mining, and preparation of federal coal under leases, licenses, and permits pursuant to 43 CFR Part 3500. The purposes of the current regulations in Part 211 (5/76) are to promote orderly and efficient operations and production practices without waste or avoidable loss of coal or other mineral-bearing formation; to encourage maximum recovery and use of coal resources; to promote operating practices which will avoid, minimize, or correct damage to the environment, including land, water, and air, and avoid, minimize, or correct hazards to public health and safety; and to obtain a proper record of all coal produced.

Surface Mining Control and Reclamation Act (SMCRA) of 1977 regulates the surface mining of all coal deposits and is implemented by the Office of Surface Mining under the regulations in Title 30 CFR Part 700. The Act and regulations provide for:

1. environmental performance standards for surface coal mining and reclamation operations;
2. inspection and enforcement procedures, including the assessment of civil penalties;
3. assistance to small operators in meeting permit application requirements;
4. requirements and approval procedures for state programs;
5. develop performance standards for the federal lands program;
6. develop the initial regulatory program to be incorporated into coal mining permits issued under state law;
7. requirements and procedures for approval of state mining permits; and
8. requirements for posting, release, and forfeiture of reclamation performance bonds.

In all cases, pursuant to Section 515 of SMCRA and Federal Regulation 30 CFR 715.13, coal mining operations will be required, as a minimum, to restore the lands affected to a condition capable of supporting the use which it was capable of supporting prior to any mining, or higher or better uses of which there is reasonable likelihood. Mining permits will not be approved unless the applicant has demonstrated that reclamation to the proposed post mining land use can be accomplished under the mining and reclamation plan.

Air Quality

Applicable legislation and regulations relating to air quality include:

1. Clean Air Act, as amended in 1977;
2. National Ambient Air Quality Standards (NAAQS);
3. New Source Performance Standards (NSPS);
4. Wyoming Environmental Quality Act of 1973; and

5. Wyoming Ambient Air Quality Regulations.

The Clean Air Act of 1970 specified that each state would be responsible for ensuring the air quality within its borders and for specifying the way it would be achieved and maintained.

On 30 April 1971, the Environmental Protection Agency (EPA) officially announced the primary and secondary *NAAQS (Federal Register* 1971). The primary standards were established to protect human health, whereas the secondary standards were established to protect the public from any known or anticipated adverse effects. Standards were put into effect for suspended particulate matter, sulfur oxides, nitrogen oxides, photochemical oxidants, carbon monoxide, and hydrocarbons.

The Wyoming ambient air quality standards were put into effect in accordance with the Wyoming Environmental Quality Act. On 22 January 1972, the State of Wyoming adopted air quality regulations that were slightly more stringent with respect to total suspended particulates (TSP) and sulfur dioxide (SO_2) than were the NAAQS regulations. Under Article 2 of the Act, the Wyoming Department of Environmental Quality, Air Quality Division, is empowered to enforce these air quality standards.

The 1970 Clean Air Act also provided the authority to establish "emission standards"(NSPS) for new stationary sources and for existing sources in categories for which national standards of performance had been established.

The 1977 Clean Air Act Amendments contain major revisions of the 1970 Act with respect to: (1) the announcement of a 3-hour (or less) primary standard for nitrogen dioxide unless there is "no significant evidence"that such a standard is needed to protect public health, (2) the identification of regions within individual states (air quality control regions) that do and do not meet the NAAQS which determine whether the areas are governed by prevention of significant deterioration (PSD) standards or by nonattainment (NA) requirements, (3) the strengthening of enforcement mechanisms for the PSD standards and the NA requirements, (4) the EPA which is required to promulgate PSD regulations for criteria pollutants other than TSP and SO_2 which already have such regulations, and (5) the NSPS for stationary sources.

The 1977 amendments have been passed by the U.S. Congress and are, therefore, law. The specific regulations needed to fulfill the PSD requirements of these amendments were promulgated on 19 June 1978. In 43 CFR 118, the EPA decided to exclude from any air quality impact assessment of a source any fugitive dust that would emanate from it. Fugitive dust is defined as particles of native soil which is uncontaminated by pollutants resulting from industrial activity. The EPA implemented these regulations only on an interim basis. If in later reassessments EPA finds a need to modify the policy, it will be done.

Paleontology

The BLM and USGS are currently developing a memorandum of understanding relating to the protection of paleontological resources on public lands. Those agencies are also developing technical guidelines to define the resource, provide evaluatory criteria, and provide measures for protection.

When finalized the provisions of these documents will serve as a basis for management of paleontological resources and appropriate protective programs.

Water Quality

Applicable legislation and regulations include:

1. Federal Water Pollution Control Act (FWPCA), as amended in 1972;
2. Wyoming Environmental Quality Act of 1973; and
3. Water Quality Standard for Wyoming, Wyoming Department of Health and Social Services, 28 June 1973.

National standards to restore and maintain the chemical, physical, and biological integrity of the Nation's waters were promulgated by the FWPCA, as amended in 1972.

Wyoming water quality standards were issued in accordance with the Wyoming Environmental Quality Act of 1973. Under Article 3 of the Act, the Wyoming Department of Environmental Quality, Water Quality Division, is empowered to enforce these water quality standards. Important prescribed standards include those which specify maximum short-term and long-term concentrations of pollution, minimum permissible concentrations of dissolved oxygen and other matter, and the permissible temperatures of the waters of the state. Effluent standards and limitations specifying the maximum amounts of pollution and waste which may be discharged into state waters are described. Current policy in Wyoming is to prohibit discharge of water containing more than 789 milligrams per liter of total dissolved solids to the Colorado River Basin. This standard may be modified to become more restrictive as a result of current litigation and public policy. Other health and water quality standards pursuant to Section 402(b) of the FWPCA, as amended in 1972, are also described.

Solid Waste Disposal

Applicable regulations include the Wyoming Solid Waste Management Rules and Regulations, 1975, that provide for solid waste disposal plans to be submitted to the State by every person or municipality proposing such plans.

The Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal), P.L. 94-580, (90 Stat. 2795) provides a method for technical and financial assistance for the development of management plans and facilities for the recovery of energy and other resources from discarded materials and for the safe disposal of discarded materials and to regulate the management of hazardous waste.

Land Quality

Applicable regulations include the Wyoming Land Quality Rules and Regulations, 1975, SMCRA, FLPMA, and the proposed cooperative agreement between the Department of Interior and the State of Wyoming under Section 523(c) of SMCRA, P.L. 95-87, which will provide procedures for approval of a mining permit and license to mine, necessary requirements for mining operations.

Cultural Resources

Applicable authorities include:

1. Antiquities Act of 1906 (34 Stat. 225; 16 U.S.C. 431-433);
2. Historic Site Act of 1935 (49 Stat. 666);
3. Historic Preservations Act of 1966 (80 Stat. 915; 16 U.S.C. 470);
4. National Environmental Policy Act (NEPA) of 1969 (33 Stat. 852; 42 U.S.C. 4321, et seq.):
5. Executive Order 11593;
6. FLPMA of 1976 (90 Stat. 2743); and
7. state laws as appropriate.

Both federal and state antiquities acts regulate antiquities excavation and collections, and both protect historical values on public lands. They provide for fines and (or) imprisonment for violators of their provisions. The Historic Preservation Act requires that certain federal undertakings be submitted for review by the National Advisory Council on Historic Preservation. Executive Order 11593 requires all federal agencies to cooperate with the nonfederal agencies, groups, and individuals to insure that federal plans and programs contribute to the preservation and enhancement of nonfederally owned historic and cultural values.

No mining or rights-of-way will be approved until the BLM has coordinated professional cultural resource (cultural resources include archeological, architectural, and historical remains) surveys with the Wyoming State Historic Preservation Officer and received his written comments and review. Additional surveys and mitigation may be necessary if surface evidence indicates further evaluation is necessary.

Water Impoundments

Requests for water impoundments covering public lands in areas of important cultural values and recreation impacts can be granted, pending decisions by the State Engineer, through the authority contained in the Reservoir Salvage Act of 1960 (74 Stat. 220) and NEPA of 1969 (83 Stat. 852, 42 U.S.C. 4321 et seq.). Before an impoundment for stockwater can be approved as part of a mining and reclamation plan, it must be demonstrated that precipitation, runoff, and (or) ground-water inflow are of the quality and quantity to be suitable and sufficient for stock use and that the impoundment will contain water. The operator must follow the Wyoming Environmental Quality Act and the rules and regulations of the Wyoming Department of Environmental Quality dealing with impoundments in the Land Quality Rules and Regulations dated 1975, Chapter III, Water Impoundments.

If a planned reservoir covers public land surface or mineral estate and its water is designated for another federally approved project, it will first be assessed under the requirements of NEPA and salvage requirements under the Reservoir Salvage Act. If cultural values are located, the "criteria for effect"under Section 106 of the National Historic Preservation Act and Section 2(b) of E.O. 11593 will be initiated by any federal agency joined in the project.

Railroads

The Interstate Commerce Act (49 Stat. 543, 49 U.S.C. 1(18)) requires the prior approval from the Interstate Commerce Commission for the extension or new construction of a line of railroad or the abandonment of operation of a line of railroad. Exempted from this authority are spur, industrial team, switching, or side tracks located wholly within one state. Commission certification is based on a balancing of the relevant economic, technical, and environmental factors.

Mineral Protection

Oil and gas leases are in effect for much of the area. Priorities for mining or drilling for oil and gas on public lands are established by the Conservation Division of the USGS. Mining operations approaching wells or bore holes that may liberate oil, gas, water, or other fluid substances must be approved in accordance with 30 CFR 211.17 and 30 CFR 211.63. Impacts on oil and gas areas can be mitigated largely by agreements among operators where significant impact on oil well siting or pipeline location arises. In extreme instances of conflict, technology is adequate through directional drilling, drainage practice, recovery of wells lost, pipeline and flow line relocation, pillar recovery, and mining methods to adequately mitigate impacts which might arise.

Endangered Species

Applicable authorities include the Endangered Species Act of 1973 (87 Stat. 844). This Act provides protection for listed species (both flora and fauna) and their critical habitat. Prior to authorization of any disturbance of lands under lease or permit, the Department of Interior will require that a survey be made to determine if listed species or their habitat may be present. If it is determined that listed species or their habitat may be present and could be affected by the proposed activites, appropriate consultation with the Fish and Wildlife Service will be carried out. No activities will be authorized until consultation is completed as per 50 CFR 402 (4 January 1978).

Floodplains Management

Executive Order 11988, 24 May 1977, directs federal agencies to take appropriate actions to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains. The executive order further states that federal agencies will avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

Protection of Wetlands

Executive Order 11990, 24 May 1977, directs federal agencies to take appropriate actions to avoid, to the extent possible, long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Fish and Wildlife Service

Applicable authorities also include the Bald Eagle Protection Act of 1969 (16 U.S.C. 668-668c.). Under this law mining operations will not be permitted in any area where such activities would molest or disturb bald and (or) golden eagles and (or) their nests.

Authorities also include the Fish and Wildlife Coordination Act of 1958. Under this law consultation and coordination with the U.S. Fish and Wildlife Service is required where a proposed or carried out action involves navigable waters and may affect the fish and wildlife resource. The legal definition of navigable waters is any body of water that will successfully float a 6-inch in diameter and 6-foot in length balsa wood log.

Wyoming State and Local Laws and Their Application to Coal Development

The state government has identified several remedies including the infusion of additional revenues to local units of government, the provision of information and technical assistance, and the introduction of state and local influence into the siting of energy facilities. Efforts to increase local revenues have included automatic increase in the distribution of state tax receipts, legislated increases in the distribution of the sales tax, Joint Powers loans, coal impact tax grants, and the enactment of an optional sales tax. The State has tried to provide information and technical assistance to local governments through the Department of Economic Planning and Development and the Industrial Development Information and Siting Act. The principal tool for controlling energy development is now the Industrial Siting Act.

Taken as a whole, these actions respond reasonably well to the problems currently plaguing energy-impacted communities in Wyoming. The State has attempted to cope with the problems of inadequate front-end revenues, a lack of local expertise, and a lack of state and local control over energy company decisionmaking. While there may be weaknesses or administrative difficulties in the current set of policies, the steps Wyoming has taken should serve to meet the goal to orderly energy development. To the extent the State wishes to assume the responsibility for compensating parties adversely affected by energy development, existing laws might be modified to target funds more directly to those actually harmed.

Local Sales Tax

Cities and counties have an option for exercising a 1% sales tax.

Farm Loan Act

Limited funds accrued from the coal impact tax may be borrowed to upgrade certain public facilities.

Joint Powers Act

Cities and counties share revenues, facilities, and services.

Industrial Siting Act

Industry is required to insure impacts are mitigated.

LAND USE PLANS, CONTROLS, CONSTRAINTS

In the environmental statement (ES) region, a large number of separate jurisdictional entities exercise certain types of land and resource use controls. The federal sector includes the National Park Service (Fossil Butte National Monument), Bureau of Reclamation (withdrawn lands in Sweetwater and Lincoln Counties), Forest Service (Wasatch and Ashley National Forests), and the BLM (public lands and mineral estate under certain private lands).

Development, management, use, and control of use on public lands have been delegated to these agencies. Controls are effected through issuance or non-issuance of a variety of leases, permits, licenses, etc. Each authorization to use public lands contains provisions to control that use. Controls exercised by the federal government for the subsurface estate are governed by the statutes authorizing the disposition and use of that estate. Foremost among these statutes is the authority for leasing coal deposits and authority to require, as a condition of such leases, an operation-management plan and a reclamation-restoration plan. Management policy has been extended in greater detail by the National Environmental Policy Act of 1969 and the Federal Land Policy and Manage-

ment Act of 1976. In certain situations, there is a joint or multiagency sharing of particular management and control functions and responsibilities, such as the cooperative agreement between the Department of the Interior and the State of Wyoming that allows the State to administer and enforce reclamation operations on federal leases in Wyoming. The subsurface estate vested in private or state ownership would normally be governed by applicable State of Wyoming statutes.

Land use planning for the area in which a checkerboard land ownership pattern exists, extending approximately 20 miles on each side of the Union Pacific Railroad main line, is of considerable importance in southwestern Wyoming. Alternating sections are in private (Rocky Mountain Energy Company) or governmental (federal or state) ownership. Successful implementation of any land use plans must involve mutual consent of the owners in this area. The majority of coal development interests in southwestern Wyoming are within this checkerboard pattern of ownership.

The Wyoming Commissioner of Public Lands is responsible for the administration, leasing, and management of lands owned by the State of Wyoming. Additionally, under State of Wyoming statutes, the state is authorized to perform and administer certain surface land use, planning, and development activities on state, county, municipal, and privately-owned properties. Two pieces of legislation passed by the 1975 Wyoming Legislature which could have a significant effect on land use are: the Wyoming State Land Use Planning Act and the Industrial Development Information and Siting Act. The Land Use Planning Act requires completion of county land use plans by 1978, and these plans could conflict or modify some of the energy development proposals. The Industrial Siting Act requires furnishing extensive information and a state permit before certain facilities can be constructed. The impacts of this act would affect developments which include gasification or electric generation proposals. Control does not apply to public properties except as provided by law.

Except where controls have specifically been delegated by statute to counties or municipalities, Wyoming retains total jurisdiction over nonpublic and privately-owned lands. Certain of these lands were conveyed to the state as part of the Act admitting Wyoming to the Union. This legislation granted Sections 16 and 36 of every township to the State for educational purposes. Use and control of these lands (including mineral leasing, rights-of-way, etc.) is governed by Wyoming law.

Under Wyoming statutes, counties have authority to effect a wide variety of controls in matters not specifically reserved to the state. The authority applies only to those portions of the county that are unincorporated. A county may regulate and restrict location and use of buildings and structures and use, condition of use, or occupancy of lands for residency, recreation, agriculture, industry, commerce, public use, and other purposes.

Less than 1% of the lands in the ES region are owned by county governments. Use and control of these lands would be governed by State law and County ordinances. The County cannot effect planning or zoning control over any lands used in the extraction or production of mineral resources unless reasonably necessary to protect the public good of its citizens. Control over mineral uses is vested in the State of Wyoming under the Wyoming Environmental Quality Act of 1973. This act also authorizes the State to control air quality, water quality, and solid waste management.

Where a county or city lacks a specific authority, provisions of the Wyoming Joint Powers Act are available to enable joint exercise of power, privilege, or authority. This legislation enables two or more agencies to jointly plan, create, finance, and operate (control) water, sewage, or solid waste facilities; fire protection agency facilities; transportation systems facilities; and public school facilities.

In the three-county ES region, only Sweetwater County has developed and adopted a comprehensive plan (currently under revision). Additionally, only Sweetwater County has passed a zoning ordinance throughout its boundaries (personal communications, Dennis Watt, see Chapter 9). However, all counties have passed or are working on subdivision regulations, mobile home park codes, and other land use control measures (Abt Associates 1977). All three counties do have a full-time planner (Lincoln and Uinta Counties have a joint office).

Nine incorporated towns or cities are in the region. Of these the largest in terms of population are Rock Springs and Green River (Sweetwater County), Kemmerer (Lincoln County), and Evanston (Uinta County). Cities have authority to effect a master plan, zoning, and other regulatory controls. Cities do not have statutory authority to effect controls over mineral extraction or produc-tion within their corporate limits. Furthermore, the Wyoming Environmental Quality Act of 1973 would preempt cities' authority to regulate and control air, water, solid waste, and land quality standards except where specifically delegated to a municipality.

Nearly all of the larger cities in the region have developed a master plan and (or) a zoning ordinance.

In summary, all of the respective jurisdictions (federal, state, and county) have sufficient authority to impose effective land and resource use controls.

INSTITUTIONAL RELATIONSHIPS

Federal

Geological Survey (USGS)

The Department of the Interior has negotiated a cooperative agreement with the State of Wyoming whereby the state will enforce and administer reclamation operations on federal leases in Wyoming. The reclamation standards included in this agreement meet both the federal and state requirements. Under this agreement, a joint annual inspection by the State of Wyoming, the USGS, and the BLM is required to assure compliance with rec-

lamation requirements. This agreement with the state will be modified to include the reclamation requirements of Section 502 of the Surface Mining Control and Reclamation Act (SMCRA) (30 USC 1201) as described in 30 CFR 715 and 716.

The Secretary of the Interior has delegated his authority to supervise exploration and mining operations on federal coal leases to the Director, USGS. The Area Mining Supervisor, acting for the Director, reviews the mining and reclamation plans and provides concurrence with the Land Quality Division of the Wyoming Department of Environmental Quality (DEQ) when the plan is determined to be acceptable. Wyoming DEQ issues the necessary permits and licenses to mine after the mining and reclamation plan is approved. Under provisions of 30 CFR 211, he has further responsibility to supervise prospecting, exploration, testing, development, mining, coal preparation and handling, reclamation, and abandonment operations on federal coal leases. Inspections can be made by the authorized representative of the Secretary on the basis of information indicating a violation of SMCRA of 1977 or the mining permit. Inspections are also made on a random basis of at least one complete inspection each 6 months (30 CFR 721.11(c)).

Bureau of Land Management (BLM)

The BLM, in consultation with the USGS, formulates the requirements to be incorporated in permits for the protection of the surface and nonmineral resources and for reclamation obligations and standards of performance required of the permittee as specified in 30 CFR 211.40. An area of operations for each lease is established by agreement between the BLM and the USGS and includes that area of the leased, permitted, or licensed lands required for development, production, and processing operations, including all related structures and facilities. The USGS is responsible for ensuring compliance on all development, mining, and processing operations conducted within the area of operations of a lease, including the enforcement of the surface protection requirements. The BLM is responsible for compliance on the lease outside the geographical area of operations. Inspections are conducted at least once annually.

BLM is responsible for authorizing various ancillary facilities such as access roads, power lines, communication lines, and railroad spurs on public lands. Rights-of-way are granted pursuant to Title V of the Federal Land Policy and Management Act (FLPMA) of 21 October 1976 (P.L. 94-579, 90 Stat. 2743).

The rights-of-way would be approved subject to standard requirements for duration of the grant, right-of-way widths, fees or costs, and bonding to secure obligations imposed by the terms and conditions of the right-of-way grants. The terms and conditions applicable to the rights-of-way are those in 43 CFR 2800 plus any other specific standard requirements and terms and conditions for the right-of-way applications in the proposed actions are covered in the specific volumes of this statement for each mine site.

Ancillary facilities on the lease area of operations which are owned by the operating company and are a normal part of the mining and reclamation plan are approved by USGS as part of the mining and reclamation plan.

The BLM and USGS are currently developing a memorandum of understanding relating to the protection of paleontological resources on public lands. Those agencies are also developing technical guidelines to define the resource, provide evluatory criteria, and provide measures for protection.

When finalized the provisions of these documents will serve as a basis for management of paleontological resources and appropriate protective programs.

Office of Surface Mining Reclamation and Enforcement (OSM)

The OSM was created to carry out the provisions of SMCRA of 1977 (PL 95-87).

Section 523 of SMCRA requires that a public lands program which includes the requirements of this act be promulgated and implemented no later than 3 August 1978. Until the public lands program is implemented, the initial regulations as required in section 502 of SMCRA and published in final form (30 CFR 715 and 716) in the 13 December 1977 *Federal Register* will apply, as modified to all federal coal leases. These regulations will be modified under the authority of section 523(c) and 702(b) of this act to meet the requirements of the Federal Coal Leasing Amendments Act of 1975 (30 USC 181 st seq.) and FLPMA of 1976 (43 USC 1701-1771). The basic change in the regulations is that of: (1) post mining land use used to design the reclamation plan will be that which is found in the surface managing agency's comprehensive land use plan; (2) permanent roads, dams, power lines, etc., to be constructed on public lands will meet the design standards of the surface managing agency, and (3) resource data collected in the process of developing the land use plan or lease stipulations will be available for use in developing the reclamation plan.

The following is a discussion of the relationship between specific requirements of the three laws and the proposed actions. The course of action described in the specific sections below serve as mitigatory measures.

Alluvial Valley Floors west of the 100th meridian and Prime Farmland. Soil surveys conducted by the BLM are required to inventory lands classified as prime farmland and as potential alluvial valley floors.

Mining and reclamation plans which propose to conduct a surface coal mining operation on or adjacent to alluvial valley floors shall include baseline data and surveys as prescribed in 30 CFR 715.17(j)(3) to establish standards which insure the preservation of the hydrologic function of these alluvial valley floors as prescribed in 30 CFR 715.17(j).

Prior to approval to mine on lands classified as prime farmlands the operator will have to provide data to demonstrate that his proposed method of reclamation will achieve, within a reasonable time, equivalent or higher levels of yield after mining as existed before mining. If

approved, special soils handling and storing stipulations will be included in the mine plan.

Lands Classified as Unsuitable For Surface Coal Mining. Prior to designating lands unsuitable for mining, except those specific tracts of land described in section 522(e) of SMCRA, the surface managing agency shall prepare a statement on: (1) the potential coal resources of the area; (2) the demand for the coal resources; and (3) the impact of such a designation on the environment, the economy, and the supply of coal. This statement shall be forwarded to the Secretary of the Interior for review along with the proposal for mine and reclamation plan approval.

Archeological and Historical Sites and Endangered and (or) Threatened Species. Inventories will be conducted on the impacted lands by the surface managing agency and stipulations necessary to protect these resources will be included in the proposed mine and reclamation plan.

Federal Lessor Protection. Prior to approval of a mining and reclamation plan, the surface of the public lands will be inventoried for legally installed appurtenances. Agreements with the federal lessor will be reached or bonds will be obtained to insure the lessor's investments are protected.

Reclaimability to Present Use. The capability of lands to support the post mining land use will be determined where existing leases are involved, prior to approval of any mining plan. Where the determination is made that certain lands cannot be reclaimed to the post mining land use, surface mining will not be permitted on these lands.

Performance Bonds. Surety bonds are required at time of lease issuance and may be readjusted prior to approval of the reclamation plan.

Water Quality Standards and Effluent Limitations. The requirements of 30 CFR 715.17 will be required to prevent additional contributions of sediment to streamflows or to runoff outside the permit area to the extent possible using the best technology currently available.

Special Bituminous Coal Provisions. These special regulations (30 CFR 716.4) may apply to the proposed North Block, Twin Creek, and South Haystack Mines in southwestern Wyoming.

Use of Explosives. The requirements of 30 CFR 715.19 will be included as a requirement of all mining and reclamation plans submitted for approval.

Water Rights. The area around the proposed mining area will be inventoried for water uses and water rights. Special requirements will be included in a mine and reclamation plan to protect the water rights of others.

Revegetation. The species and pounds per acre of plant seed to be used in the reclamation process will be listed in the mining and reclamation plan. A complete inspection of reclamation associated procedures will be made at least once every 3 months and a partial inspection will be made at least once each month.

Public Health and Safety. The authorized representative of OSM has the authority to enter and inspect for compliance with the initial performance standards in 30 CFR 715 and 716. He has the authority to order a cessation of mining or reclamation operations if, in the course of an inspection or investigation, he finds conditions, practices, or violations of the initial performance standards which create an imminent danger to the public health or safety or conditions or practices which can be expected to cause significant environmental harm. The mining and reclamation plans included in this statement were submitted for review prior to the promulgation of initial regulations required under Section 501-502 of SMCRA of 1977, RC 95-87. Therefore, in some cases the mining and reclamation plans may not fully reflect the requirements of the initial regulations. However, in this statement the initial regulations are being included as a modification requirement of the mining and reclamation plans. Both the USGS and the OSM will review the plans which will not be recommended for approval until the plans reflect the requirements of the initial regulations.

Fish and Wildlife Service

Coordination is required with the U.S. Fish and Wildlife Service in generally the following environmental circumstances: Fish and Wildlife Coordination Act—when a proposed or carried out action would or could involve navigable waters and a fish and wildlife resource; Bald Eagle Act—when a proposed or carried out action would or could involve an eagle, its nest, and (or) its habitat; Endangered Species Act—when a proposed or carried out action would or could involve an endangered/threatened species and (or) its habitat.

State and County

State of Wyoming

Wyoming Department of Environmental Quality (DEQ). DEQ has authority relating to air quality, solid wastes, water quality, and mining and mine-land reclamation. The Land Quality Division issues permits and licenses to mine after concurrence by the USGS and the BLM and upon subsequent approval of a mining and reclamation plan. Mined-land reclamation provisions of the mining and reclamation plan are administered and enforced by the Land Quality Division. The Air Quality Division issues permits to construct coal mines and permits to operate coal mines after approval of applications with regard to plans for monitoring and controlling air contaminants. The Water Quality Division issues permits to construct settling ponds and waste water systems. They also issue National Pollutant Discharge Elimination System permits for discharging waste water. The Solid Waste Division issues construction fill permits and industrial waste facility permits for solid waste disposal during construction and operation of coal mines.

Commissioner of Public Lands. Utility lines, roads, and railroad spurs crossing state land would require easements from the Commissioner of Public Lands (Wyoming Statutes 36-7).

Wyoming Highway Department. Relocation of highways and all utility line crossings of state and federal aid highways requires authorization from the Wyoming Highway Department.

Wyoming State Engineer. Use of surface or ground water for mining and coal processing operations requires a permit from the State Engineer. Water pipelines also require a permit from the State Engineer.

Relationship to Land Use Plans

BLM Planning

Management Framework Plans (MFPs) for the Pilot Butte, Salt Wells, and Pioneer Trails planning units were updated as of January 1977. The three planning units encompass the entire regional ES area. All proposals for coal development and lands of possible interest to the mining industry for potential coal development were addressed in the BLM's Land Use Planning process.

Generally the recommendations and decisions of the MFPs allowed the following:

1. The designation of areas of potential interest for coal development which are compatible for mining under the multiple use concept of management.

2. The analysis of areas of interest for possible future mining. Stipulations would be placed on the specific areas in the Salt Wells planning unit which would prohibit surface mining or occupancy within one-eighth mile of Salt Wells Creek (400 acres).

3. The approval of mining and reclamation plans on existing leases. Specific development proposals which would be allowed under this recommendation are North Block Mine— Kemmerer Coal Company; Twin Creek Mine—Cumberland Coal Company; South Haystack Mine—Cumberland Coal Company; Long Canyon Mine—Sun Energy Development Company and Rocky Mountain Energy Company; and Black Butte Mine—Black Butte Coal Company. Projected development of existing leases without pending mine plans (projected mining and reclamation plans—future proposals) would also be allowed with necessary environmental stipulations under this recommendation.

4. The issuing of rights-of-way in support of energy development. Specific use authorizations in support of mine development with necessary environmental stipulations would be allowed by this recommendation.

Local Planning

An update of the Comprehensive Plan for Rock Springs, Wyoming, August 1975, projects community growth through the time frame of the analysis. Projections are based on indicated industrial development including that coal development being addressed in this ES. As an example of projections contained in the plan, mine workers, including trona, coal, and other miners, are projected to increase from 4,700 persons in 1976 to 7,665 in 1990. Construction workers are projected to decrease from 4,084 in 1976 to 2,546 in 1985 and then increase to 2,758 in 1990. The needs for housing and community services are also projected through 1990 relating to increased population and other projections.

This plan does not specifically propose community development or services which would be required to meet the needs of proposed growth. Studies, however, are proposed or underway for expansion of schools, sewage, domestic water, and storm drainage systems; capital improvements; and other services.

Sweetwater County prepared a comprehensive plan in 1972 that is being updated, but Lincoln and Uinta Counties have not yet adopted a plan. Sweetwater County is zoned primarily for agricultural use, a zone change to an industrial zone would be required for mining activities.

CHAPTER 4

THE ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTIONS

This chapter discusses the impacts that would result from implementation of the proposed actions. Impacts are linked to specific aspects of the proposed mining and reclamation plans and are quantified to show magnitude, intensity, duration, and incidence.

In addition to an analysis of the environmental impacts of the proposed actions, an assessment is made of all other expected developments in the region through 1990, including other coal-related development and growth of other economic activities such as oil and gas and power plants. The specific impacts of the proposed actions are then placed in perspective with the cumulative impacts of all economic activity in the region.

This chapter also provides the bases for assessing unavoidable adverse impacts in the following chapter.

The mining and reclamation plans in this statement were submitted for review prior to passage of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), P.L. 95-87. Therefore, in some cases the mining and reclamation plans (M&RPs) may not fully reflect the requirements of the law and initial regulations. However, it is believed that they present sufficient data to permit analysis of the impacts that will be associated with mining in this area. Prior to departmental approval, the plans will be returned to the applicants for modification to incorporate the requirements of SMCRA. When the M&RPs are returned to the Department, they will be reevaluated to insure that they meet the requirements of SMCRA and appropriate federal regulations and that the potential impacts are covered by this environmental statement (ES). This procedure will facilitate the timely and efficient consideration of these applications under the evolving requirements of SMCRA, and we believe this procedure is reasonable in view of the evolving character of the law.

Chapter 3, Planning and Environmental Controls, includes reference to appropriate provisions of SMCRA, and these were incorporated into the following impact analysis to the extent possible at this time. However, it is realized some of the adverse impacts described will be precluded by implementation and enforcement of the new law. This is especially true in regard to impacts on the air, water, soil, and vegetation resources. In any event, the worst possible case is covered.

AIR QUALITY

Emissions from Coal Mining

All existing pollutant concentrations such as total suspended particulates (TSP), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), hydrocarbons (HC), and carbon monoxide (CO) would be affected by development of the proposed actions. The significant emissions from coal mining are the fugitive dusts created by mining and related activities. Coal mining contributes only small amounts to the other ambient pollutant concentrations mentioned above.

The Environmental Research and Technology Air Quality (ERTAQ) model was employed to calculate ground-level concentrations of suspended particulates (SP) attributable to the mines alone for annual and 24-hour averaging periods for the years 1980, 1985, and 1990. Meteorological specifications for input to the model were derived from 5 years of observations taken at Rock Springs and Fort Bridger. The Rock Springs data were employed for the Long Canyon and Black Butte project areas. The Fort Bridger data were used for the South Haystack, Twin Creek, and North Block project areas. A stability wind rose was employed to calculate annual average concentrations at 128 receptor locations. The concentrations calculated for each receptor represent the weighted annual average for 480 possible weather conditions (16 wind directions times 6 wind speed categories times 5 stability classes). These concentrations were then compared to the annual Prevention of Significant Deterioration (PSD) increments.

The 24-hour standards, which are written not to be exceeded more than once per year, suggest worst-case analyses to estimate whether or not concentrations exceeding these standards would occur. Worst-case 24-hour conditions are defined as the combination of poor atmospheric dispersion conditions and wind direction persistence leading to maximum 24-hour impact. These factors were also derived from the Rock Springs and Fort Bridger data. The impact at each of the 128 receptors was calculated for each wind direction and corresponding conditions of stability, persistence, and wind speed. In this manner, the worst-case impact at each receptor due to emissions from the proposed actions was determined.

Appendix B of this ES and the Chapter 4, Regional Technical Report (ERT 1978a), on file at the Rock Springs District Office of the BLM contain detailed discussions of the emissions from coal mining, their sources, and the total emissions for the proposed actions. The model used, the assumptions inherent in such modeling,

and the meteorological conditions that were included in the modeling are also discussed. In addition, a discussion of the uncertainties associated with the modeling of coal mines is included. This discussion is an important one because the significance, accuracy, and limitations of the impact results are a function of the modeling uncertainties.

Best management practices were not necessarily included in the air quality impact analysis. Only those mitigating measures discussed in the mining and reclamation plans were included in the modeling. In any event, the worst case is discussed, and best management practices will produce fewer and less intense impacts. Chapter 8 of all site specifics contain an air quality alternative which discusses best management practice impacts.

Impacts of Particulate Emissions

The model predictions presented below are evaluated for PSD regulations, since these apply to source specific impact alone. However, under the new PSD review procedure, 43 Code of Federal Regulations (CFR) 118, the impact of fugitive dust emissions from surface coal mines would not be included in the air quality analyses for the PSD increments, nor for national ambient air quality standards (NAAQS). Particulate emissions from industrial process units of a surface mine are typically less than 1% of the total emissions from a mine. Hence, the proposed actions are not expected to exceed the Class II increment under the new review procedures.

Because the new PSD review procedures were not implemented by EPA before the modeling was completed, the regional air quality analyses have been prepared using the previous PSD regulations. The previous regulations require the air quality impact of all particulate emissions from a surface mine be analyzed for PSD review.

Model Predictions of Annual Average Impact on SP Concentrations for 1980

Map R4-2A depicts the incremental increase from the proposed actions to annual average SP concentrations in 1980. The subregional concentrations presented in the text are also attributable to the five proposed mines alone. (Subregional isopleth maps are presented in the Chapter 4, Regional Technical Report, ERT 1978a). The model results, therefore, represent the proportional contribution of mining activity to the levels specified in the national and state ambient air quality standards.

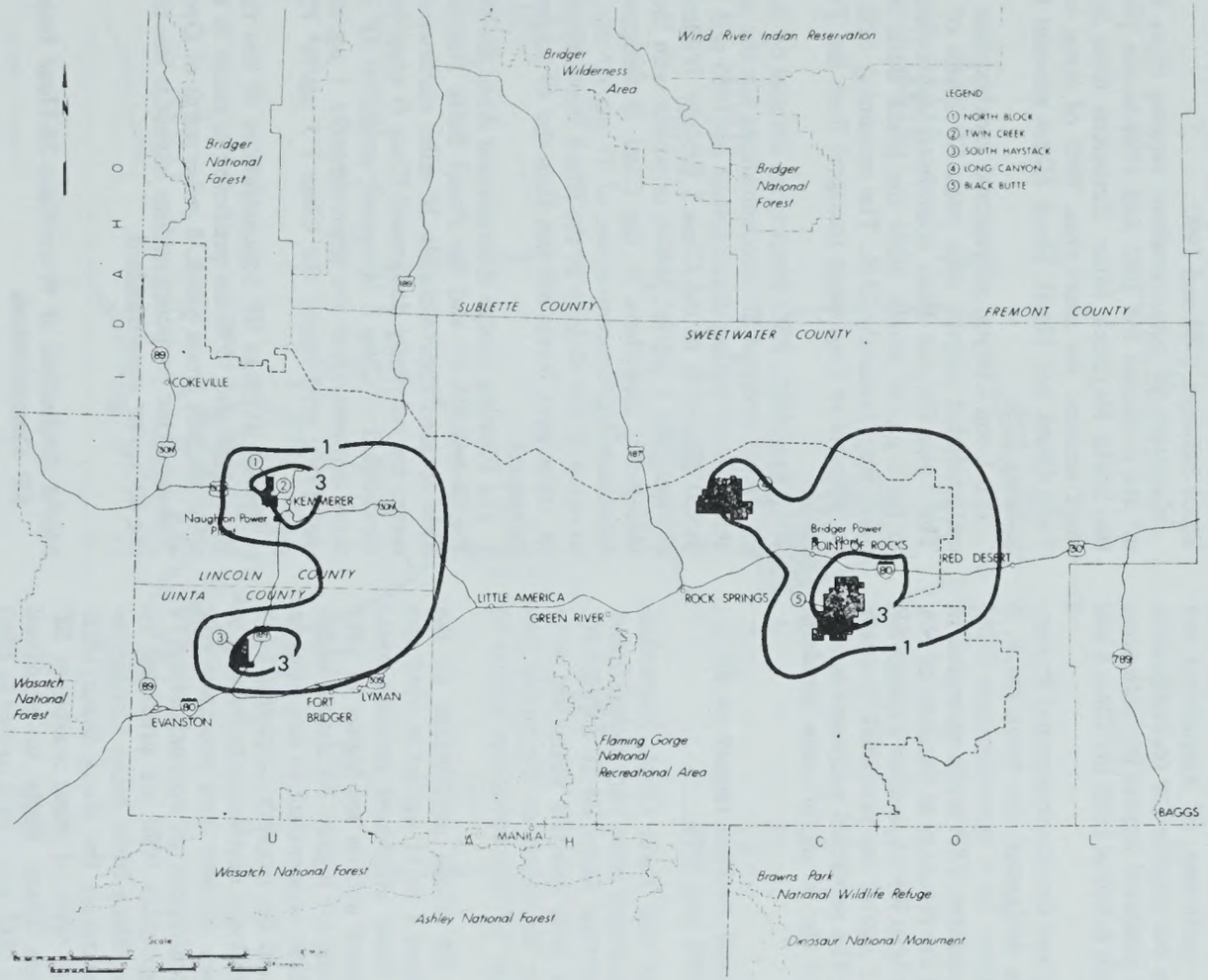
Regionally, predicted annual average SP concentrations from the mining activities range from 1 to 7 $\mu g/m^3$. Note that the highest concentrations occur close to the actual mine sites, and that the isopleths depicting such levels are skewed to the east and northeast. This type of distribution is attributable to the predominant frequency of west and southwest winds as recorded at the Fort Bridger and Rock Springs meteorological stations. Interaction between mines lining up is not a major consideration for annual averages, since none of the proposed action mines line up during the predominant wind directions. The highest concentrations of approximately 7 $\mu g/m^3$ were predicted to occur in the proximity of the Black Butte Mine. Concentrations associated with the Black Butte Mine alone account for more than 96% of the 7 $\mu g/m^3$ totals. Second highest annual average SP concentrations range from 5 to 7 $\mu g/m^3$ about the Black Butte Mine. The Black Butte Mine alone contributes more than 92% of these predicted levels. Further downwind of Black Butte where predicted SP levels range from 1 to 3 $\mu g/m^3$, the contribution from the Black Butte Mine ranges from 68% to 90%. At further downwind distances, the interaction from the other mines becomes evident. Long Canyon and North Block have a minimal effect (less than 2%) due mostly to low emission rates. Through long range transport, the South Haystack Mine and Twin Creek Mine contributions are apparent. It is evident that in the vicinity of any one mine, that particular mine would account for a major portion of predicted SP concentrations. However, predicted SP levels further downwind from a specific source consist of contributions associated with the interaction of two or more sources.

The North Block and Twin Creek subregion indicates peak annual average SP concentrations of approximately 3 $\mu g/m^3$. North Block and Twin Creek contribute greater than 22% and 74%, respectively, to the 3 $\mu g/m^3$ SP levels adjacent to North Block; South Haystack accounts for 2%. North Block, Twin Creek, and South Haystack account for 10%, 88%, and 2%, respectively, of the 3 $\mu g/m^3$ predicted SP levels adjacent to Twin Creek. The Twin Creek Mine dominates 1980 simulated concentrations in this subregion, since its emission rate is more than seven times that of North Block (refer to Table RB-2A). The mines located near Rock Springs have little or no effect on predicted levels in this subregion due to the low frequency of easterly winds and large distance between the Kemmerer and Rock Springs areas.

Maximum annual average SP concentrations of approximately 5 $\mu g/m^3$ are predicted to occur about the South Haystack Mine. South Haystack and Twin Creek contribute about 96% and 4%, respectively, to these levels. Predicted SP concentrations of 1 to 3 $\mu g/m^3$ located to the northeast of the South Haystack Mine are a by-product of interacting sources. To these levels, the South Haystack, Twin Creek, and North Block Mines contribute approximately 87%, 8%, and 2%, respectively. Note that emissions from South Haystack dominate predicted SP levels in the vicinity of the mine. In general, this is the case for all of the mine sites.

The lowest subregional SP concentrations are simulated to occur in the vicinity of the Long Canyon Mine, whose emissions are the lowest among the five proposed mines for 1980. Peak SP levels are predicted to be on the order of 1 $\mu g/m^3$, attributable predominantly to the Long Canyon and Black Butte Mines.

In accordance with the Clean Air Act Amendments of 1977 and associated PSD regulations, the entire segment of southwest Wyoming is classified as a Class II area. The only exception is the Bridger Wilderness Area (see Map R4-2A), which is a Class I area. Allowable PSD increments are depicted in Table R2-2B. Predicted SP



Map R4-2A

1980 PREDICTED ANNUAL AVERAGE SP CONCENTRATIONS ($\mu g/m^3$)

ATTRIBUTABLE TO THE PROPOSED ACTION MINES ALONE

Source: Environmental Research and technology (ERT) 1978a.

levels in this area are less than 1 $\mu g/m^3$, which is below the Class I 5 $\mu g/m^3$ increment. Predicted SP levels elsewhere peak at 7 $\mu g/m^3$ in the vicinity of the Black Butte Mine. Since the annual Class II increment is 19 $\mu g/m^3$, the predicted impact from the most probable level of mining development is well within PSD regulations for 1980.

The Flaming Gorge Recreational Area shown on Map R4-2A and the Fossil Butte National Monument (located approximately 10 miles northwest of Kemmerer) are presently Class II regions but eligible for reclassification to Class I. However, the predicted impact for both areas is less than 1 $\mu g/m^3$, which is below both the Class I and II PSD increments.

The State of Wyoming and the Environmental Protection Agency (EPA) have designated the trona patch, 6 miles north of Green River, as a nonattainment (NA) area. This indicates that ambient TSP levels measured in the trona patch exceeded the NAAQS at the time of NA designation. As shown in Map R4-2A, annual average SP concentrations less than 1 $\mu g/m^3$ are predicted to occur in this NA area in 1980. The predicted proposed actions impact is less than 2% of the 60 $\mu g/m^3$ state standard.

Model Predictions of Annual Average Impact on SP Concentrations for 1985 and 1990

Except for Black Butte and Twin Creek, particulate emission rates for each proposed mine vary insignificantly from 1985 to 1990; therefore, Maps R4-2B and R4-2C, depicting SP impacts for both analysis years, are very similar. Consequently, the discussion of the model predictions for annual average SP concentrations applies to both years.

Regionally, predicted SP levels attributable to the mining operations vary from 1 to 11 $\mu g/m^3$ in 1985 and 1 to 9 $\mu g/m^3$ in 1990. Since combined emission rates emanating from the proposed actions are higher in 1985 than 1990, predicted impacts are higher. As shown in the results for 1980, the highest concentrations occur close to the actual mine sites, and the isopleths depicting such levels are skewed to the east and northeast attributable to the predominant frequency of west and southwesterly winds. The highest concentrations of approximately 11 $\mu g/m^3$ in 1985 and 9 $\mu g/m^3$ in 1990 are predicted to occur in the vicinity of the Black Butte Mine. Concentrations resulting from emissions at the Black Butte Mine alone comprise more than 96% of these maximum SP levels. Contributions from Black Butte to predicted levels of 3 to 11 $\mu g/m^3$ in 1985 and 3 to 9 $\mu g/m^3$ in 1990 range from 85% to 97% for both analysis years. Black Butte's highest contributions occur in the near vicinity of the mine and decrease with distance away from the mine.

The second highest subregional concentrations of 7 $\mu g/m^3$ are predicted to occur about the North Block and Twin Creek Mines. The Twin Creek Mine accounts for 82% of the simulated 5 to 7 $\mu g/m^3$ SP levels, and North Block accounts for 16% in the area adjacent to the Twin Creek Mine. The remaining 2% is attributable to South Haystack. Twin Creek, North Block, and South Haystack comprise approximately 54%, 44%, and 2%, respectively, of the 5 to 7 $\mu g/m^3$ simulated SP concentrations adjacent to North Block. The Twin Creek Mine dominates predicted SP levels in this subregion, since its emission rates for 1985 and 1990 are about three times that of North Block. However, contributions from the North Block Mine to simulated SP concentrations increase significantly when compared to 1980 because of a vast increase in emissions projected to occur at North Block between 1985 and 1990.

Maximum SP concentrations ranging from 3 to 5 $\mu g/m^3$ are predicted for 1985 and 1990 in the proximity of the South Haystack Mine. Emissions from South Haystack account for more than 90% of these levels. The Twin Creek and North Block Mines account for the remaining 10%.

The Long Canyon subregional area exhibits the smallest predicted impact with peak SP levels of 2 $\mu g/m^3$. The Long Canyon Mine contributes approximately 65% to the 2 $\mu g/m^3$ levels; while the Black Butte Mine comprises approximately 23%. The remaining 12% is mostly attributable to long range transport from the Twin Creek Mine.

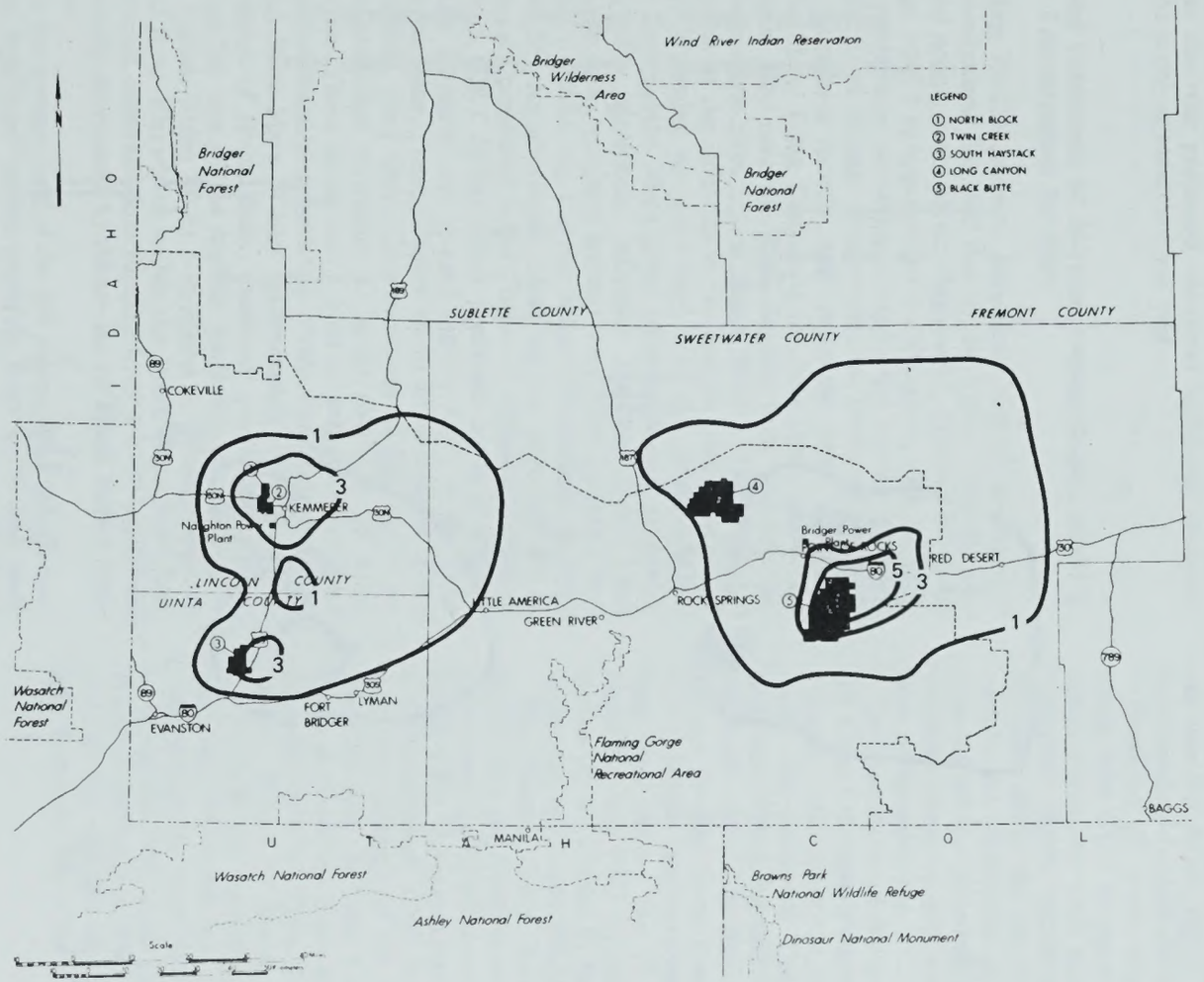
All applicable PSD restrictions are met by the predicted annual average SP concentrations for the most probable level of mining development for 1985 and 1990. Predicted SP levels in the Class I Bridger Wilderness Area are less than 1 $\mu g/m^3$, which complies with the 5 $\mu g/m^3$ increment. Elsewhere in the Class II designated areas, maximum SP concentrations of 11 $\mu g/m^3$ are predicted to occur in the vicinity of the Black Butte Mine. However, these peak levels are less than the 19 $\mu g/m^3$ Class II increment.

The Flaming Gorge Recreational Area shown in Maps R4-2B and R4-2C and the Fossil Butte National Monument located approximately 10 miles northwest of Kemmerer are currently designated Class II areas but may be reclassified to Class I. However, predicted SP concentrations in these areas are approximately 1 $\mu g/m^3$ in 1985 and 1990, well below the Class I 5 $\mu g/m^3$ PSD increment.

Annual average SP concentrations of less than 1 $\mu g/m^3$ in 1985 and 1990 are predicted to occur in the vicinity of the NA trona patch, 6 miles north of Green River. The predicted proposed actions impact is less than 2% of the 60 $\mu g/m^3$ state standard.

Model Predictions of Worst-Case 24-Hour Impact on SP Concentrations

Worst-case predictions of regional 24-hour average SP concentrations associated with the proposed action mines are presented in Maps R4-2D through R4-2F. The meteorology used to simulate these concentrations is discussed in Appendix B. Concentrations were simulated for all sixteen wind directions, coupled with the corresponding stability and persistence data; the maximum SP level at each receptor was then selected to represent worst-case impact. Consequently, the 24-hour averages shown throughout the ES region cannot occur simultaneously. In fact, it is somewhat unrealistic to evaluate worst-case

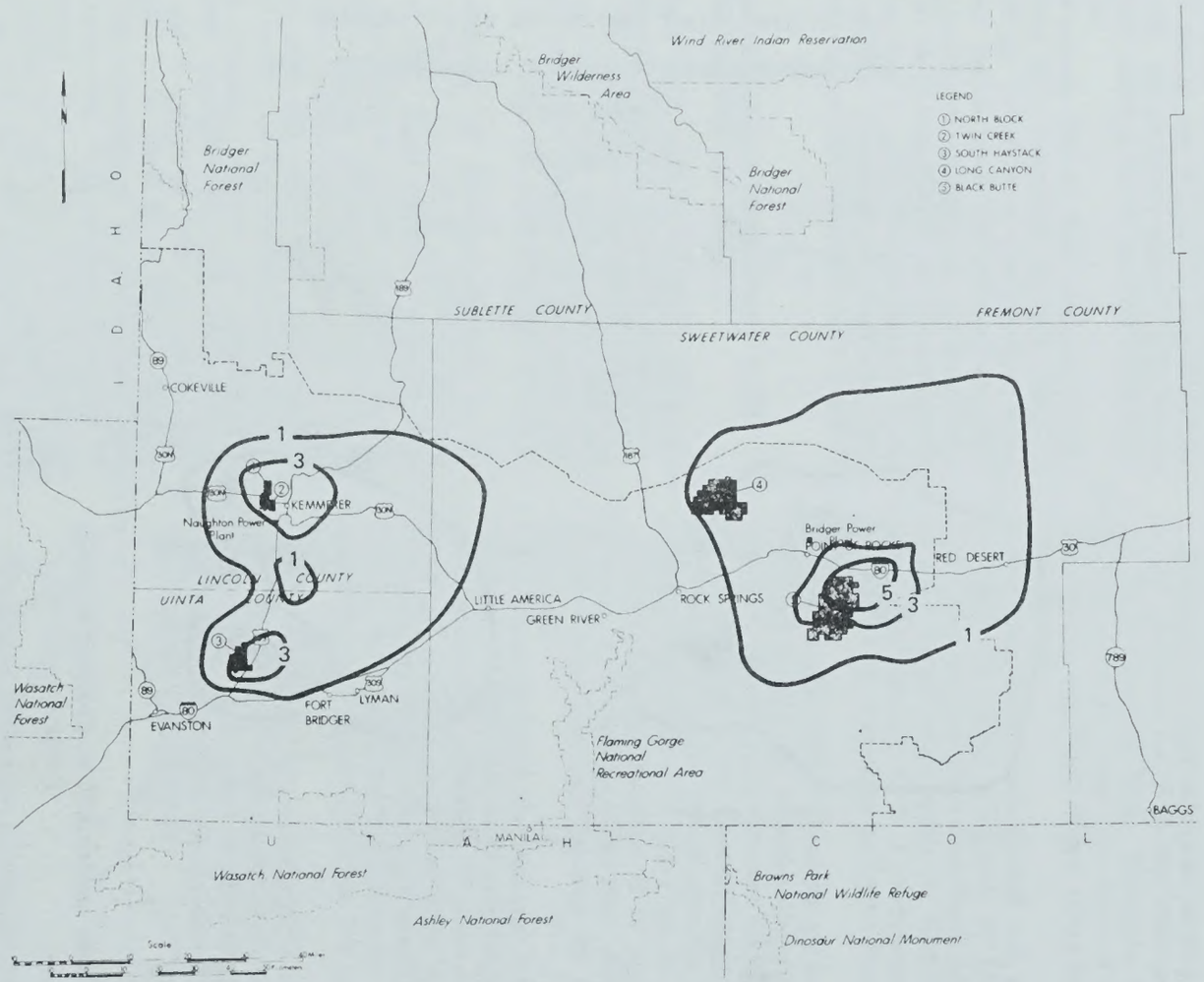


Map R4-2B

1985 PREDICTED ANNUAL AVERAGE SP CONCENTRATIONS ($\mu g/m^3$)

ATTRIBUTABLE TO THE PROPOSED ACTION MINES ALONE

Source: ERT 1978a.



Map R4-2C

1990 PREDICTED ANNUAL AVERAGE SP CONCENTRATIONS ($\mu g/m^3$)

ATTRIBUTABLE TO THE PROPOSED ACTION MINES ALONE

Source: ERT 1978a.

24-hour average impact regionally since the meteorological conditions leading to maximum SP levels at one location will not pertain to all receptor locations. The wind direction determining peak SP concentrations depends on the location of each receptor relative to the mine sites. In short, simulated 24-hour average concentrations are indicative of absolute worst-case impacts corresponding to a composite of maximum model predictions for all wind directions; such SP levels cannot occur simultaneously throughout the region, but the assumption is made that the predicted values at individual receptors could occur at least once per year.

Model Predictions of 24-Hour Average Impact on SP Concentrations for 1980

Map R4-2D presents simulated 24-hour average SP concentrations for 1980 due to the impact from the proposed action mines alone. Regionally, depicted SP levels range from 5 to approximately 120 $\mu g/m^3$, with the highest predictions occurring close to the mining activities. In the Rock Springs area, worst-case predicted SP levels are associated mostly with emissions from the Black Butte Mine. Long Canyon is the only other operational mine in 1980 near the Rock Springs area, and its emissions are less than 8% of Black Butte's. The elongated portions of the isopleths in the eastern portion of southwest Wyoming are associated with the wind direction that lines up the Black Butte Mine with such receptors. The only significant influence resulting from Long Canyon is to receptors located very close (within 3 to 5 miles) to the Long Canyon Mine. (Illustrations of simulated SP concentrations close to the proposed action mines are presented in the Chapter 4, Regional Technical Report, (ERT 1978a).) Peak predicted levels of approximately 20 $\mu g/m^3$ are located slightly south of the Long Canyon Mine. These concentrations are associated with a northerly wind flow. Concentrations of 20 $\mu g/m^3$ are also predicted to occur 12 miles southeast of Long Canyon. These levels result from an east-southeast wind direction dispersing pollutant levels emanating from the Black Butte Mine. Within approximately 2.5 miles north-northeast of Black Butte, maximum predictions peak at 80 $\mu g/m^3$, one of the highest simulated throughout the ES region. These levels correspond to a west-southwest wind flow. Elsewhere within the Black Butte subregion, predicted concentrations ranging from 4 to 80 $\mu g/m^3$ are generally dominated by dispersion of Black Butte's emissions.

In the western half of the ES region, Map R4-2D indicates significant impact resulting from north and south wind flow. Because of the relative locations of North Block, Twin Creek, and South Haystack, both northerly and southerly winds result in the interaction of pollutants dispersing from all three surface mines. Such interaction is seen to effect simulated SP concentrations approximately 60 miles north and south of Kemmerer. Interaction between the South Haystack Mine and the North Block/Twin Creek mining subregion is small or nonexistent under easterly or westerly wind flow. In general, predicted levels east or west of South Haystack (within about 40 miles) are dominated by fugitive dust emissions dispersing from the South Haystack Mine. Similarly, predicted levels within approximately 50 miles east or west of North Block and Twin Creek are mainly a function of emissions emanating from these two mines. Maximum predicted SP concentrations in the North Block/Twin Creek subregion are on the order of 120 $\mu g/m^3$, although the peak predicted concentration within 2 miles south of Twin Creek is 227 $\mu g/m^3$. Because of its high annual emission rates (2,405 tons per year compared to 334 tons per year for North Block), the Twin Creek Mine dominates predicted concentrations in this subregion.

Predicted SP levels about the South Haystack Mine range from 20 to 80 $\mu g/m^3$. Again, interaction between mines is apparent with north and south wind directions. However, within approximately 3 miles of the South Haystack Mine, the major portion of simulated concentrations are attributable to South Haystack. This is the case for all the proposed actions; the interactive effect between mines is not significant at receptors located close to the mine site.

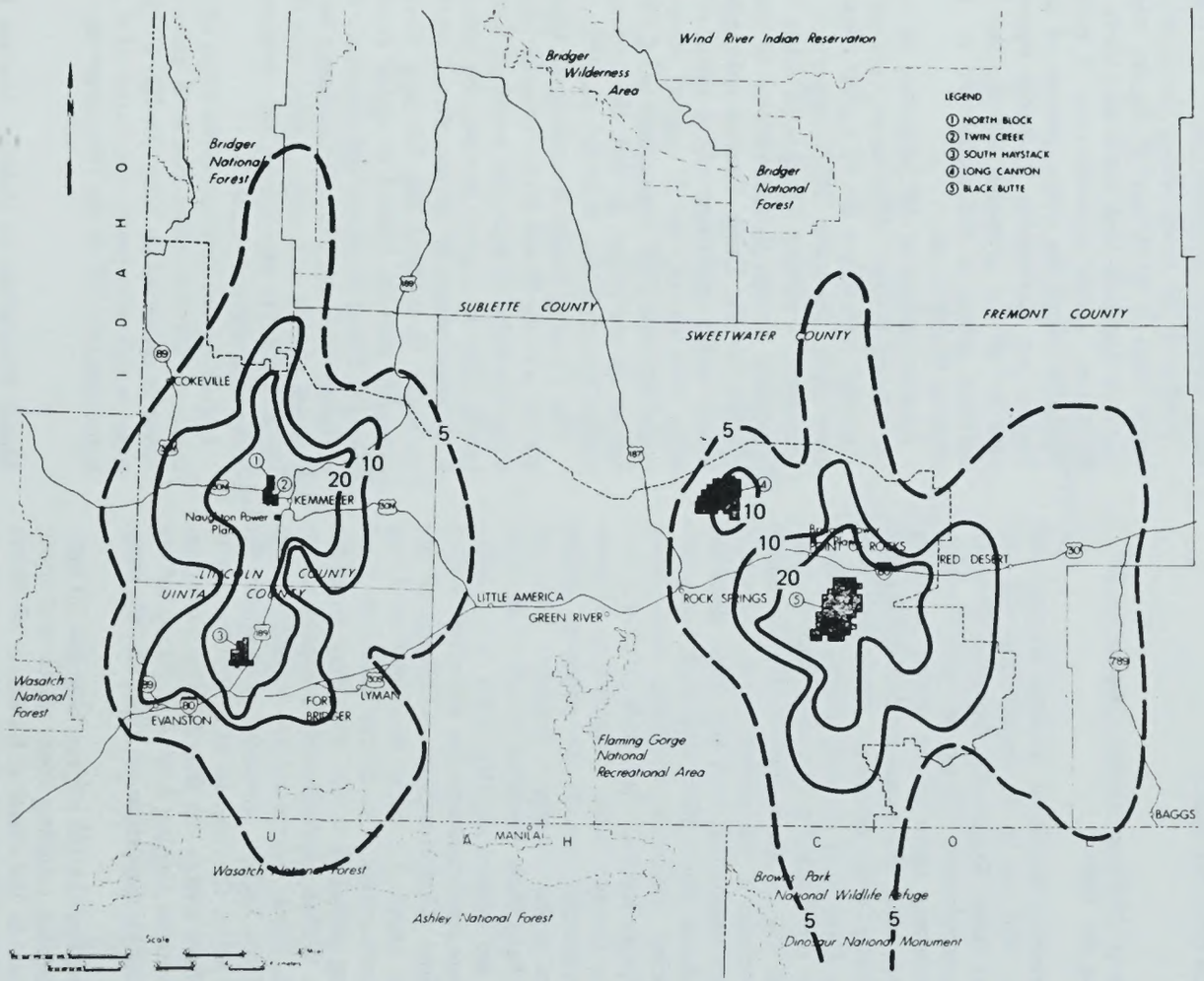
Concentrations of SP predicted to occur throughout the Class I Bridger Wilderness Area are on the order of 1 $\mu g/m^3$, well below the 10 $\mu g/m^3$ allowable PSD increment. The allowable PSD increment for the rest of southwest Wyoming (designated Class II) is maintained regionally except in the vicinity of the surface mines. Except for the Long Canyon subregion, predicted SP levels within approximately 6 miles of the other four mine sites exceed the 37 $\mu g/m^3$ increment. Note that under the new PSD regulations (43 CFR 118), these violations do not occur. In fact, the surface mines are well within the applicable NAAQS and PSD regulations.

The Flaming Gorge Recreational Area shown on Map R4-2D and the Fossil Butte National Monument (located approximately 10 miles northwest of Kemmerer) are currently Class II regions but may be redesignated to Class I. Concentrations of SP less than 4 $\mu g/m^3$ are predicted to occur throughout the Flaming Gorge Area, which complies with the Class I 10 $\mu g/m^3$ increment. Predicted levels at Fossil Butte are approximately 20 $\mu g/m^3$, which complies with the Class II increment but exceeds the allowable Class I increment. Again, with the application of the 43 CFR 118 regulations, the violations of the Class I increment will not occur.

Impact of the most probable level of mining development on the NA trona patch, 6 miles north of Green River is indicated in Map R4-2D. Predicted concentrations in this area are on the order of 4 $\mu g/m^3$, which is approximately 3% of the 150 $\mu g/m^3$ state standard.

Model Predictions of 24-Hour Average Impact on SP Concentrations for 1985

Predicted SP impact from the proposed action mines alone is depicted in Map R4-2E. Regionally, simulated SP levels range from 5 to 120 $\mu g/m^3$, although somewhat higher concentrations are predicted to occur close to the North Block and Twin Creek Mines. In the eastern portion of the ES region, estimated emissions emanating from the Black Butte Mine dominate predicted

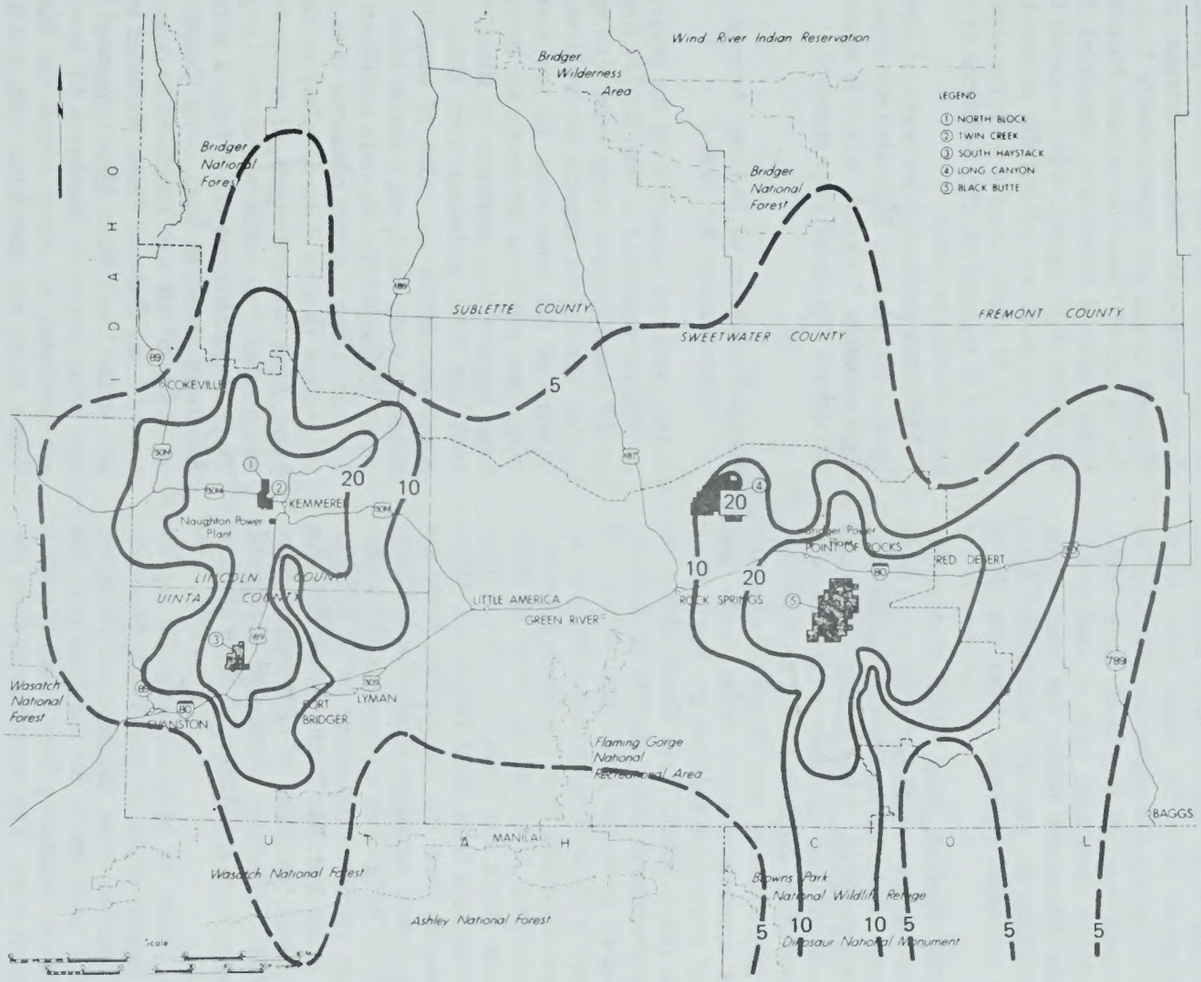


Map R4-2D

1980 PREDICTED 24-HOUR AVERAGE SP CONCENTRATIONS ($\mu g/m^3$)

ATTRIBUTABLE TO THE PROPOSED ACTION MINES ALONE

Source: ERT 1978a.



Map R4-2E

1985 PREDICTED 24-HOUR AVERAGE SP CONCENTRATIONS ($\mu g/m^3$)

ATTRIBUTABLE TO THE PROPOSED ACTION MINES ALONE

Source: ERT 1978a.

impact. Long Canyon's estimated emission rate is less than 9% of the Black Butte Mine emission rate. Therefore, the skewing effect illustrated by the isopleths is associated, in general, with the wind direction that lines up the Black Butte Mine with a given receptor. The Long Canyon Mine does influence concentrations predicted very close to the active site (within 3 to 5 miles), but its contribution elsewhere is insignificant. The predicted concentrations in the Long Canyon subregion are low, with maximum levels of approximately 20 $\mu g/m^3$. Predicted levels of 20 to 40 $\mu g/m^3$ southeast of Long Canyon are attributable to an east-southeast wind direction dispersing emissions from the Black Butte Mine. Peak levels of approximately 120 $\mu g/m^3$ are predicted to occur to the north-northeast of the Black Butte Mine. Such concentrations are associated with a south-southwest wind direction. Elsewhere within the Black Butte subregion, concentrations are generally determined from the dispersion of estimated emissions from the Black Butte Mine alone.

Similar to the 1980 analysis, Map R4-2E depicts significant impact resulting from north and south wind flow in the western portion of the ES region. Due to the relative locations of North Block, Twin Creek, and South Haystack, both northerly and southerly winds result in the interaction of pollutants dispersing from all three surface mines. Such interaction is seen to affect simulated SP concentrations approximately 60 miles north and south of Kemmerer. Interaction between the South Haystack Mine and the North Block/Twin Creek mining subregion is small or nonexistent under easterly or westerly wind flow. In general, predicted levels east or west of South Haystack (within about 40 miles) are a result of fugitive dust emissions dispersing from the South Haystack Mine. Similarly, predicted levels within about 50 miles east or west of North Block and Twin Creek are a function of emissions emanating from these two mines. However, in 1985, emissions from the Twin Creek Mine are three times the estimated emissions from North Block; therefore, Twin Creek has greater influence in this subregion. The maximum predicted concentration of 332 $\mu g/m^3$ is predicted to occur less than 2 miles south of Twin Creek and North Block, resulting in high impact from northerly wind flow. Elsewhere within the subregion, predicted levels range from approximately 20 to 120 $\mu g/m^3$.

Peak simulated levels of approximately 80 $\mu g/m^3$ occur in a small region south of the South Haystack Mine. (Note that emissions from the mine are projected to decrease in 1985.) Such levels, for the most part, are attributable to emissions emanating from South Haystack influenced by a north wind. The contribution from the North Block and Twin Creek Mines is minimal so close to South Haystack. However, the interaction phenomenon induced by north wind flow is evident further downwind. Elsewhere, the South Haystack Mine is the sole source of predicted levels within about 40 miles east or west of the mine site.

For PSD increments, simulated concentrations in the Bridger Wilderness Area are less than 2 $\mu g/m^3$, which does not interfere with the 10 $\mu g/m^3$ Class I increment. The remaining portion of southwest Wyoming is designated Class II. Except for Long Canyon, simulated concentrations above the 37 $\mu g/m^3$ allowable PSD increment are predicted to occur as far out as 12 miles from some of the mine sites (see the site-specific analyses for greater detail). Note that under the new PSD regulations (43 CFR 118), these violations do not occur. In fact, the surface mines are well within the applicable NAAQS and PSD regulations.

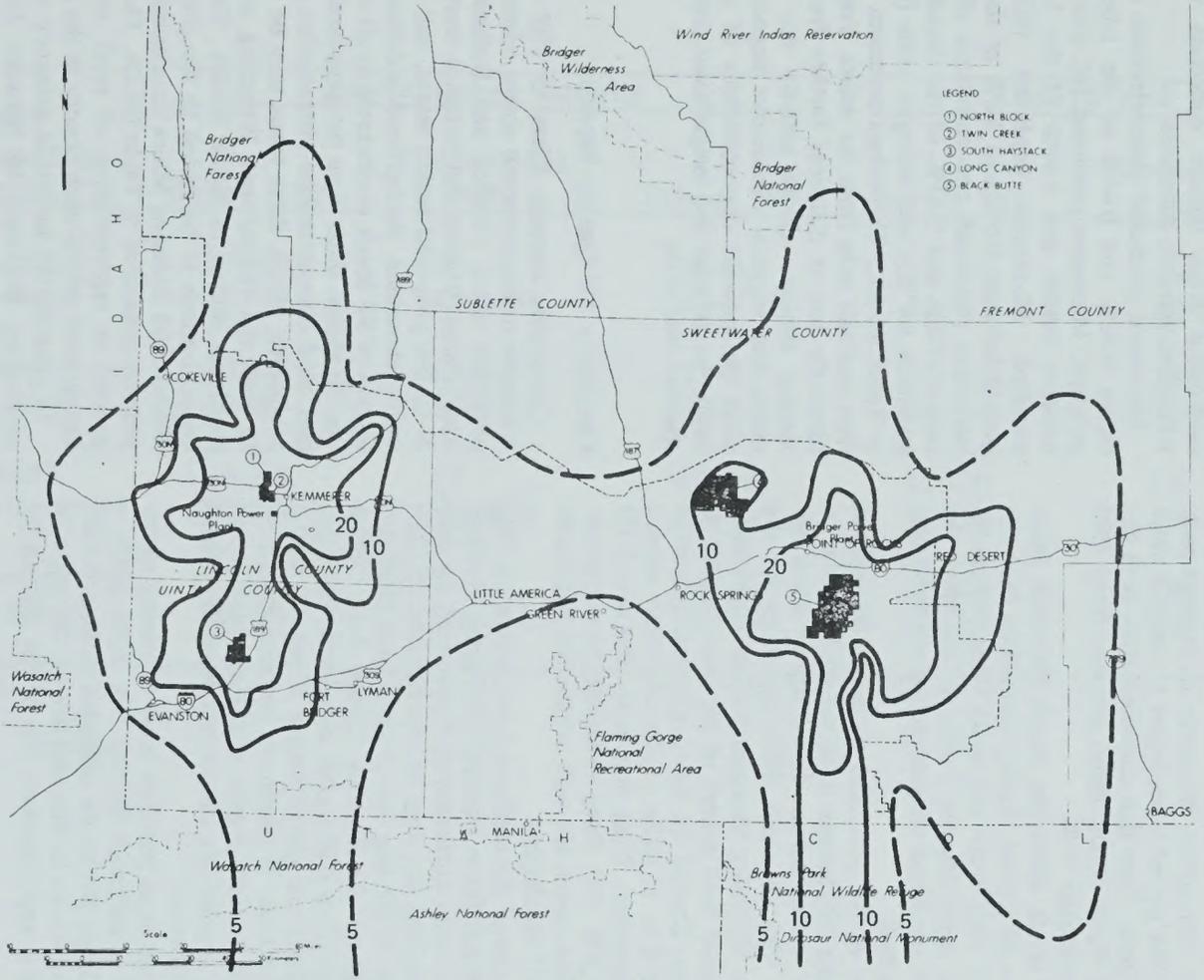
Presently, both the Flaming Gorge National Recreation Area and Fossil Butte National Monument are Class II regions, but they may be redesignated to Class I. Predicted worst-case 24-hour average concentrations at Flaming Gorge are approximately 5 $\mu g/m^3$, or less than the 10 $\mu g/m^3$ Class I increment. However, at the Fossil Butte National Monument, simulated SP levels are on the order of 20 $\mu g/m^3$, which exceeds the Class I increment but does not exceed the allowable Class II increment of 37 $\mu g/m^3$. Again, with the application of the 43 CFR 118 regulations, the violations of the Class I increment would not occur.

The trona patch, 6 miles north of Green River, is designated an NA area. Simulated SP impact for this area is approximately 7 $\mu g/m^3$, which is approximately 5% of the federal 150 $\mu g/m^3$ state standard.

Model Predictions of 24-Hour Average Impact on SP Concentrations for 1990

The predicted impacts from the proposed action mines in 1990 are presented in Map R4-2F. Regionally, simulated SP concentrations range from 5 to approximately 120 $\mu g/m^3$; the highest impacts are predicted to occur in the vicinity of the mine sites. In the Rock Springs area, worst-case predicted SP levels are generally determined from fugitive dust emissions at Black Butte. Similar to 1980 and 1985, emissions from Black Butte (a surface mine) are almost an order of magnitude higher than emissions from the Long Canyon Mine (an underground mine). Consequently, the only significant influence resulting from Long Canyon emissions is to receptors located very close (within 3 to 5 miles) to the Long Canyon Mine. Peak concentrations of approximately 20 $\mu g/m^3$ are predicted to occur about the Long Canyon Mine. These concentrations result from a northerly wind flow dispersing emissions from Long Canyon. Concentrations of 20 $\mu g/m^3$ are also simulated to occur 12 miles southeast of Long Canyon. These predicted levels are attributable to the Black Butte Mine influenced by an east-southeast wind direction. Maximum SP levels of 120 $\mu g/m^3$ are predicted to occur about the Black Butte Mine. These levels are associated with winds from the west-southwest. Elsewhere within the Black Butte subregion, predicted concentrations are generally dominated by dispersion of Black Butte's fugitive dust emissions.

In the western half of the ES region, Map R4-2F indicates significant impact resulting from north and south wind flow as discussed earlier. The interaction of South Haystack, Twin Creek, and North Block is seen to affect simulated SP concentrations approximately 60 miles north and south of Kemmerer. Interaction between the



Map R4-2F

1990 PREDICTED 24-HOUR AVERAGE SP CONCENTRATIONS ($\mu g/m^3$)

ATTRIBUTABLE TO THE PROPOSED ACTION MINES ALONE

Source: ERT 1978a.

South Haystack Mine and the North Block/Twin Creek mining subregion is small or nonexistent under easterly or westerly wind flow. In general, predicted levels east or west of South Haystack (within about 40 miles) are dominated by fugitive dust emissions dispersing from the South Haystack Mine. Similarly, predicted levels within about 50 miles east or west of North Block and Twin Creek are a function of emissions emanating from these two mines. However, since the Twin Creek Mine emissions are almost three times that of North Block's, Twin Creek has porportionally greater influence in this area. Maximum predicted SP concentrations in this subregion are approximately 120 $\mu g/m^3$. However, an isolated peak concentration of 264 $\mu g/m^3$ is predicted to occur 2 miles south of Twin Creek. Note that emissions from both the Twin Creek and North Block Mines decrease from 1985 to 1990 by approximately 17%.

Predicted SP levels about the South Haystack Mine range from 20 to 80 $\mu g/m^3$. Again, interaction between mines is apparent with north and south wind directions. However, within approximately 3 miles of the mine, the major portion of simulated concentrations are attributable to South Haystack.

Concentrations of SP predicted to occur throughout the Class I Bridger Wilderness Area are on the order of 1 $\mu g/m^3$, which is well below the 10 $\mu g/m^3$ allowable PSD increment. The allowable PSD increment for the rest of southwest Wyoming (designated Class II) is maintained on a regional basis except in the near vicinity of the surface mines. Except for Long Canyon, predicted SP levels within 6 to 12 miles of the mine sites exceed the 37 $\mu g/m^3$ increment. Note that under the new PSD regulations (43 CFR 118), these violations do not occur. In fact, the surface mines are well within the applicable NAAQS and PSD regulations.

The Flaming Gorge Recreational Area shown on Map R4-2F and the Fossil Butte National Monument (located approximately 10 miles northwest of Kemmerer) are currently Class II regions but may be redesignated to Class I. Concentrations of SP less than 5 $\mu g/m^3$ are predicted to occur throughout the Flaming Gorge Area, which complies with the Class I 10 $\mu g/m^3$ increment. Predicted levels at Fossil Butte are approximately 20 $\mu g/m^3$, which complies with the Class II increment but exceeds the allowable Class I increment. Again, with the application of the 43 CFR 118 regulations, the violations of the Class I increment will not occur.

Impact from the most probable level of mining development in 1990 is indicated for the NA trona patch, 6 miles north of Green River. As indicated in Map R4-2F, predicted concentrations in this area are on the order of 5 $\mu g/m^3$, which is approximately 3% of the 150 $\mu g/m^3$ state standard.

Gaseous Pollutants

Vehicle emissions would be the only source of gaseous air pollutants attributable to the proposed action mines. Federal and State regulations include limitations on ambient air concentrations of the vehicle-related pollutants CO, HC, NO_2, and SO_2.

Ambient concentrations were not modeled because of the lack of detailed data on vehicle use and applicable background data for these pollutants. However, recent studies (U.S. Department of the Interior 1976) of the impact of vehicle emissions associated with western coal mines were reviewed to estimate the probable range of impact. In these studies, concentrations of the above pollutants for similar mining operations had either been modeled or estimated from standard approximation techniques. In all cases, the levels of maximum pollutant concentrations from vehicle emissions were insignificant when compared to standards.

Maximum predicted concentrations of CO ranged between 0.02% and 0.44% of the 1-hour 40,000 $\mu g/m^3$ standard. Maximum predicted HC concentrations ranged between 0.88% and 3.44% of the 3-hour 160 $\mu g/m^3$ standard. Maximum predicted NO_2 concentrations ranged between 0.6% and 3.0% of the standards, while maximum predicted concentrations of SO_2 ranged between 0.02% and 0.33% of the standards. (Air quality standards for SO_2 and nitrogen oxide (NO_x) are depicted in Table R2-2A.) The values represent predictions at less than one-half mile from the mines. Predictions were significantly less at distances further from the mines. Assuming similar vehicle activity for all western coal mines, the regional cumulative impact of vehicle emissions on ambient concentrations of gaseous pollutants would be minimal and insignificant compared to their respective standards.

Cumulative Air Quality Impacts

Cumulative impacts refers to TSP concentrations attributable to the proposed action mines, plus the private, projected mines (Winton and Reliance) plus projected background. Winton and Reliance were modeled similarly to the proposed action mines, and predicted impacts were determined. Background is defined as the conglomeration of SP levels attributable to all sources throughout the ES region other than the proposed mines. The resultant total concentrations characterize predicted ambient air quality; hence, these totals may be directly compared to both the federal and Wyoming ambient air quality standards shown in Table R2-2A. The background SP concentrations to be added to the proposed actions and Winton and Reliance Mines simulations for each analysis year are presented in Table R4-2A. These levels are categorized as representative of rural, industrial, or urban background within each county in the ES region.

In general, the industrial category corresponds to the area along Interstate 80 between Little America and Rock Springs, where several point sources are located (this area is referred to as the "trona patch") and the areas in the near vicinity of the Naughton and Bridger Power Plants. The urban category characterizes background about the urban areas within the ES region, such as Rock Springs, Kemmerer, Evanston, and Green River. Rural background corresponds to the remainder of southwest Wyoming. Background levels presented in

Table R4-2A

BACKGROUND TSP CONCENTRATIONS
($\mu g/m^3$)

Period of Interest	TSP Averaging Period	Sweetwater County			Lincoln and Uinta Counties		
		Rural TSP	Industrial TSP	Urban TSP	Rural TSP	Industrial TSP	Urban TSP
Baseline	Annual	10-20	20-35	35-45	10-20	20-35	20-35
	24-Hour	35-50	45-160	80-155	30-45	60-85	60-85
1980	Annual	13-23	23-45	33-43	10-20	18-28	18-28
	24-Hour	30-55	60-225	70-130	30-50	50-75	50-75
1985	Annual	13-23	23	28-38	10-20	18-28	18-28
	24-Hour	30-55	60-225	55-110	30-50	50-75	50-75
1990	Annual	13-23	23	25-35	10-20	18-28	18-28
	24-Hour	30-55	60-225	50-100	30-50	50-75	50-75

Source: ERT 1978a.

Table R4-2A exhibit a wide range within each category indicative of a large degree of uncertainty associated with regional background levels. As discussed in the Chapter 2, Regional Technical Report (ERT 1978a), these background concentrations are derived from a small number of monitors within the region and the background ranges presented in Table R4-2A are merely approximations of trends in regional TSP air quality. Note, however, that the geographical representativeness of a particulate monitor is limited, and that background levels at locations relatively distant from the monitors could be quite different.

For short-term averages, it is unlikely that the meteorology corresponding to the measured background concentrations is coincident with the 24-hour period determining worst-case impacts attributable to the proposed actions. However, in an attempt to quantify cumulative 24-hour TSP impacts, worst-case meteorological assumptions have been made. Pictorial representations of cumulative regional TSP impacts on annual and 24-hour average concentrations are shown in Maps R4-2G through R4-2L for all three analysis years. The depicted isopleths represent simulated SP levels attributable to the proposed action and the Winton and Reliance Mines in combination with the mid-points of the background ranges given in Table R4-2A. Use of these background range mid-points is purely arbitrary and for illustrative purposes only; the likelihood of its actual occurrence is unknown. Maps R4-2G through R4-2L are characterized by a gross smoothing effect in comparison with the maps depicting impact from the proposed actions alone. The domination of background accounts for such TSP distributions. Note that letters A through H on the cumulative maps depict isolated receptor points of maximum predicted TSP concentrations.

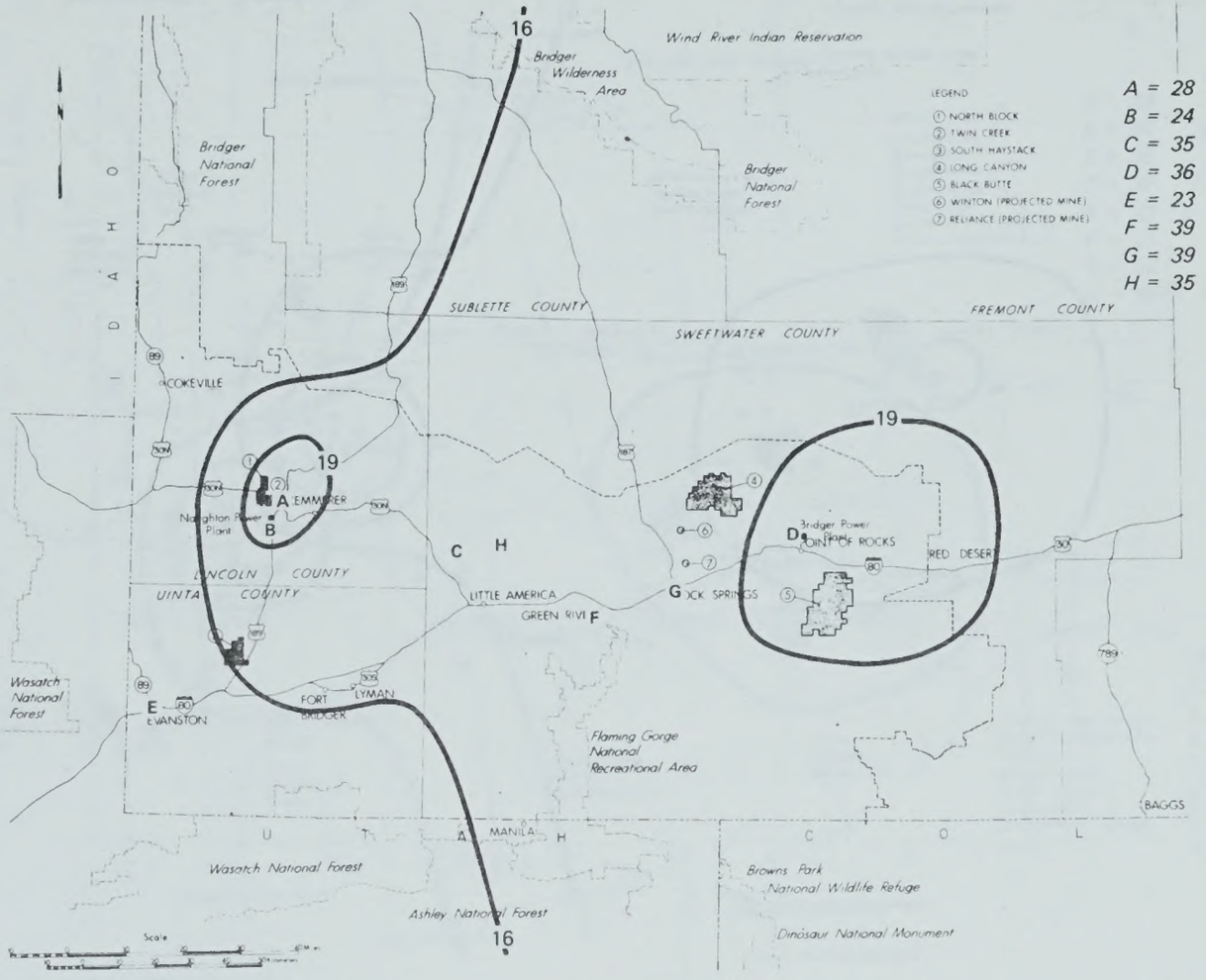
The basis for determining cumulative TSP impacts must be stressed prior to evaluation. Namely, ambient particulate levels measured at a limited number of available monitors are assumed to characterize background concentrations throughout the entire ES region, and meteorology is assumed to be coincident for background levels and simulated SP impacts attributable to the proposed actions. Cumulative TSP impact discussions that follow delineate a range of predicted concentrations in accordance with Table R2-2A, since at any distance from an existing monitoring site, the true deviation of regional background levels is unknown.

Predicted Annual Average Cumulative Impacts on TSP Concentrations for 1980, 1985, and 1990. In 1980, the highest background concentrations are projected for the industrial and urban sectors of Sweetwater County. When combined with simulated mine concentrations, resultant total levels about both the trona patch and Jim Bridger Power Plant range from 24 to 46 $\mu g/m^3$. (Note that Winton and Reliance are not operational in 1980.) Ranges of TSP from 34 to 44 $\mu g/m^3$ are predicted to occur in the vicinity of Rock Springs. To these cumulative totals, mining activities contribute less than 4%. In the proximity of Kemmerer, projected background plus mine simulations result in TSP concentrations of 23 to 33 $\mu g/m^3$; background alone accounts for approximately 80% of these levels. The remainder is attributable primarily to the Twin Creek Mine. Close to the Black Butte Mine where simulated mine concentrations are the highest in the region for 1980, cumulative concentrations range from 20 to 30 $\mu g/m^3$. Black Butte accounts for less than 40% of these levels; the remainder is attributable to background. Near the South Haystack Mine, cumulative levels range from 15 to 25 $\mu g/m^3$. The South Haystack Mine alone accounts for one-third of these concentrations, the rest is attributable to background. Regionally, background sources account for the majority of cumulative TSP levels. In the vicinity of the mine sites, the contribution from the mines to total predicted levels is greater than elsewhere; however, background levels still dominate.

Similar to 1980, the highest background concentrations are projected to occur in the industrial and urban sectors of Sweetwater County for 1985 and 1990. Cumulative concentrations for both years range from 24 to 46 $\mu g/m^3$ about the trona patch and 25 to 47 $\mu g/m^3$ in the vicinity of the Jim Bridger Power Plant. Background alone accounts for greater than 92% of such levels. In the Rock Springs area, total predicted ambient air quality levels range from 29 to 39 $\mu g/m^3$ in 1985 and 26 $\mu g/m^3$ to 36 $\mu g/m^3$ in 1990. Again, background alone contributes greater than 96% to these TSP levels. In the vicinity of Kemmerer, cumulative TSP concentrations range from approximately 25 to 35 $\mu g/m^3$ for 1985 and 1990. Mining activities alone account for less than 30% of such predicted total concentrations. Of this 30%, the Twin Creek, North Block, and South Haystack Mines account for approximately 82%, 16%, and 2%. Close to the Black Butte Mine, peak simulated cumulative concentrations range from 24 to 34 $\mu g/m^3$ in 1985 and 22 to 32 $\mu g/m^3$ in 1990. The Black Butte Mine alone comprises approximately 50% of these levels; the remaining half is attributable to rural background concentrations. Near South Haystack, cumulative TSP levels range from 15 to 25 $\mu g/m^3$ for both 1985 and 1990. Rural background accounts for more than 70% of these predicted levels; the remaining percentage is attributable primarily to the South Haystack Mine. Cumulative TSP levels near Long Canyon are estimated to be less than 22 $\mu g/m^3$ for both analysis years. The Long Canyon Mine contributes less than 2 $\mu g/m^3$, and background comprises the rest.

Cumulative TSP concentrations are predicted to be less than the Wyoming 60 $\mu g/m^3$ and federal 75 $\mu g/m^3$ standards. It is evident that except in the vicinity of the Black Butte Mine, background sources dominate total predicted TSP levels. The proportional regional impact associated with the development of the mines alone is minimal for all three analysis years.

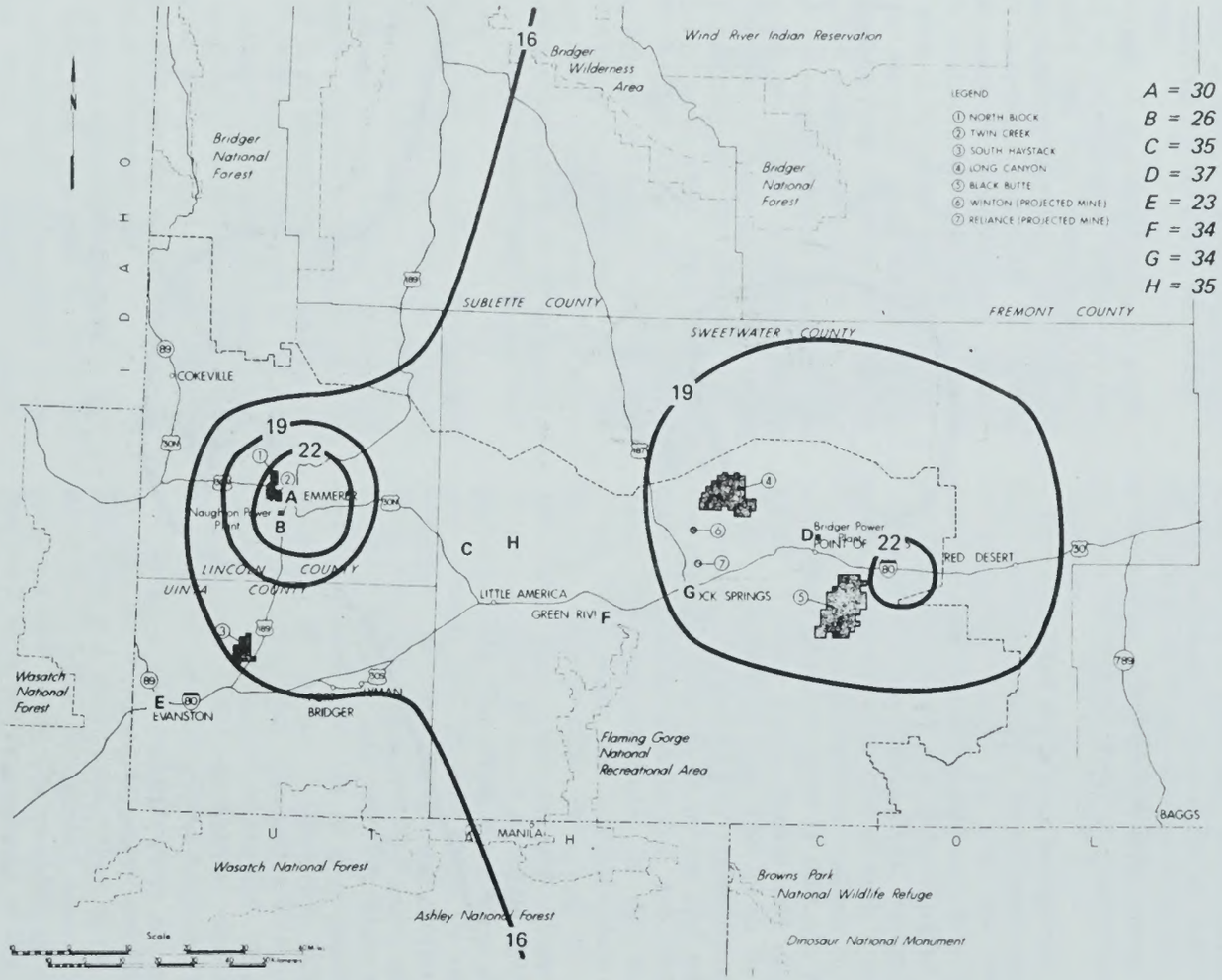
Predicted 24-Hour Average Cumulative Impacts on TSP Concentrations for 1980, 1985, and 1990. Maximum background concentrations in 1980 are projected to occur throughout the industrial sections of Sweetwater County. As depicted in Table R4-2A, the upper background limit of 225 $\mu g/m^3$ is greater than the Wyoming 150 $\mu g/m^3$ standard. When combined with the worst-case simulated mine concentrations, resultant total concentrations range from 64 to 229 $\mu g/m^3$ in the trona patch and 70 to 235



Map R4-2G

CUMULATIVE 1980 PREDICTED ANNUAL AVERAGE TSP CONCENTRATIONS ($\mu g/m^3$)

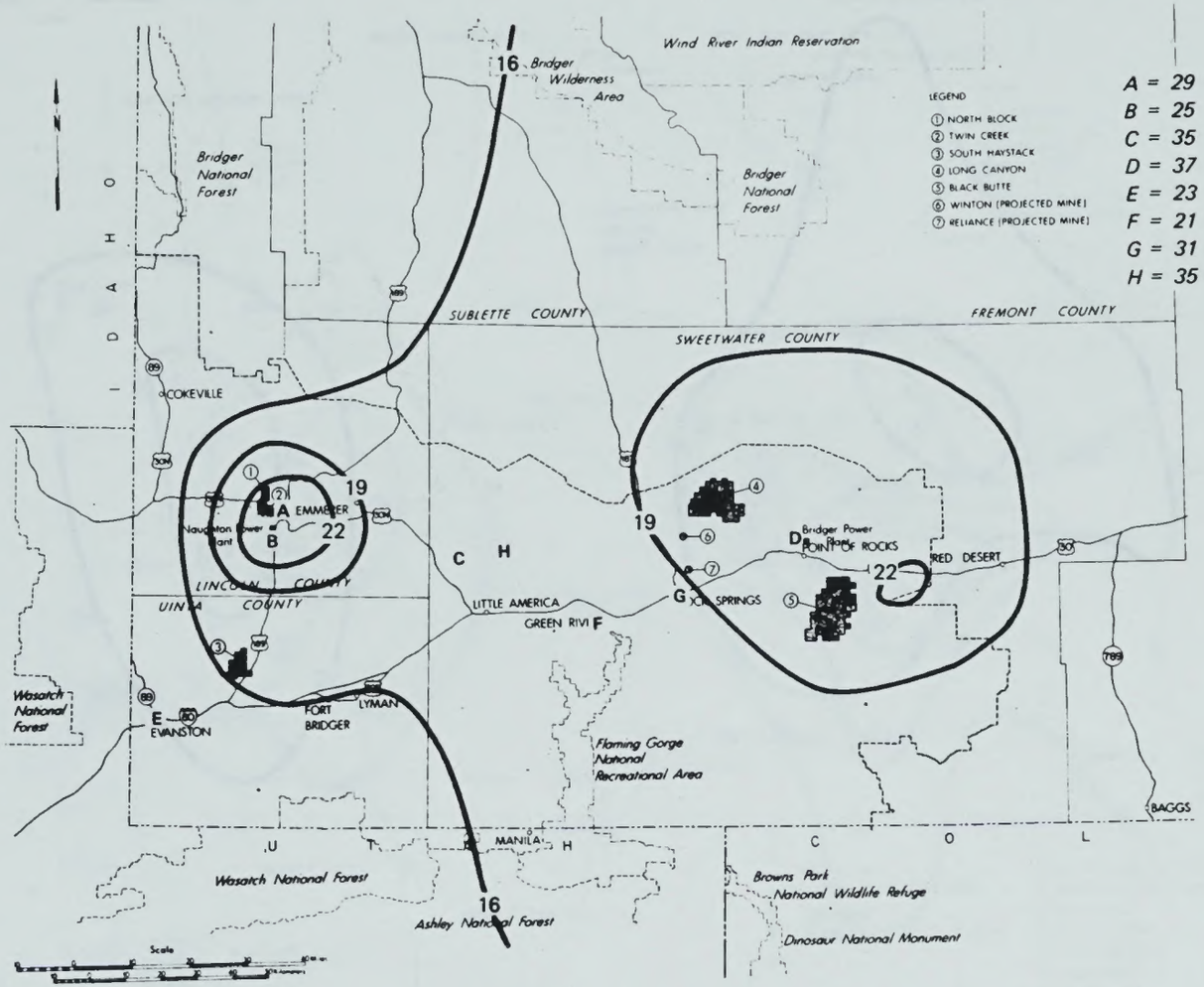
Source: ERT 1978a.



Map R4-2H

CUMULATIVE 1985 PREDICTED ANNUAL AVERAGE TSP CONCENTRATIONS ($\mu g/m^3$)

Source: ERT 1978a.



Map R4-2I

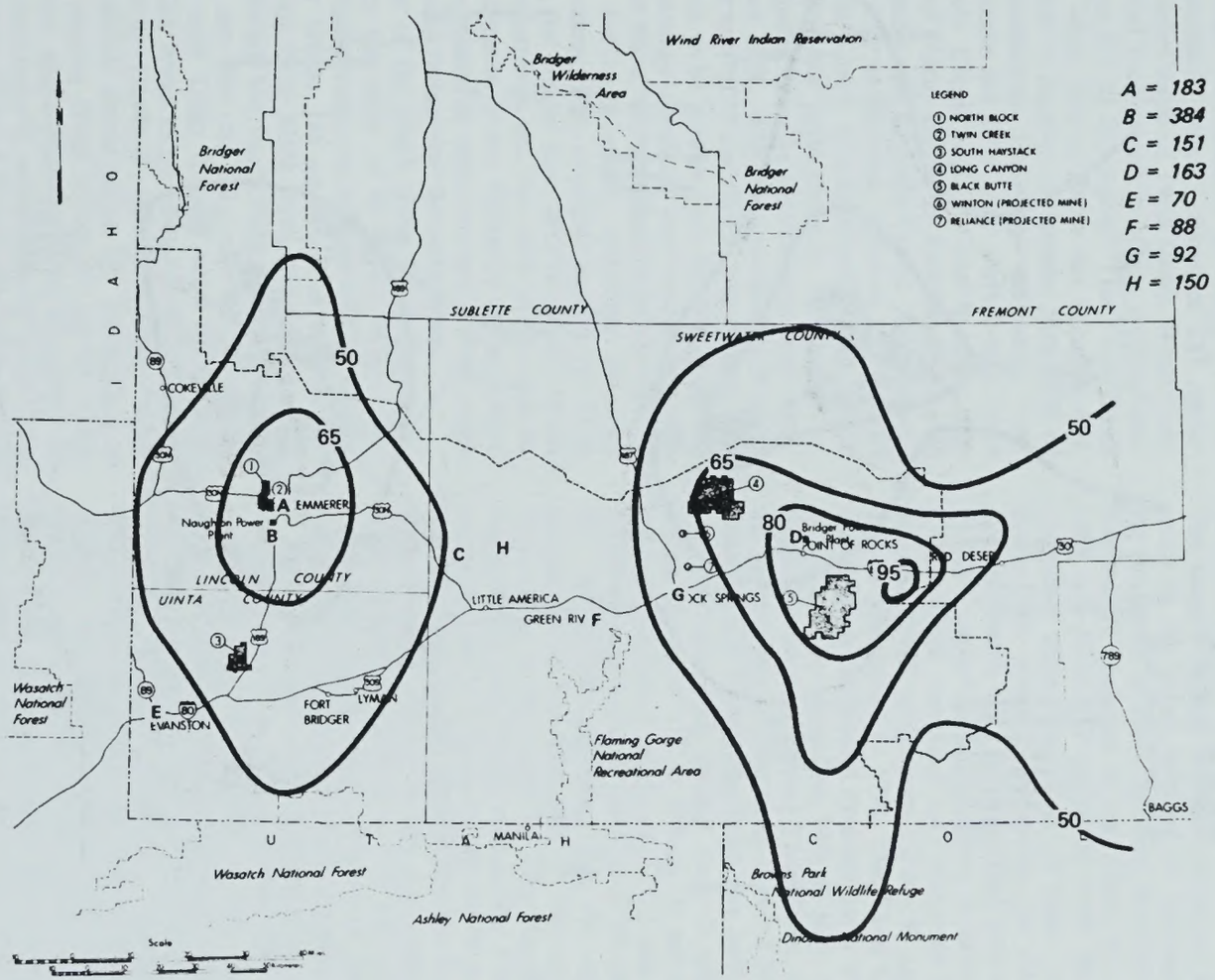
CUMULATIVE 1990 PREDICTED ANNUAL AVERAGE TSP CONCENTRATIONS ($\mu g/m^3$)

Source: ERT 1978a.

Map R4-2J

CUMULATIVE 1980 PREDICTED 24-HOUR AVERAGE TSP CONCENTRATIONS ($\mu g/m^3$)

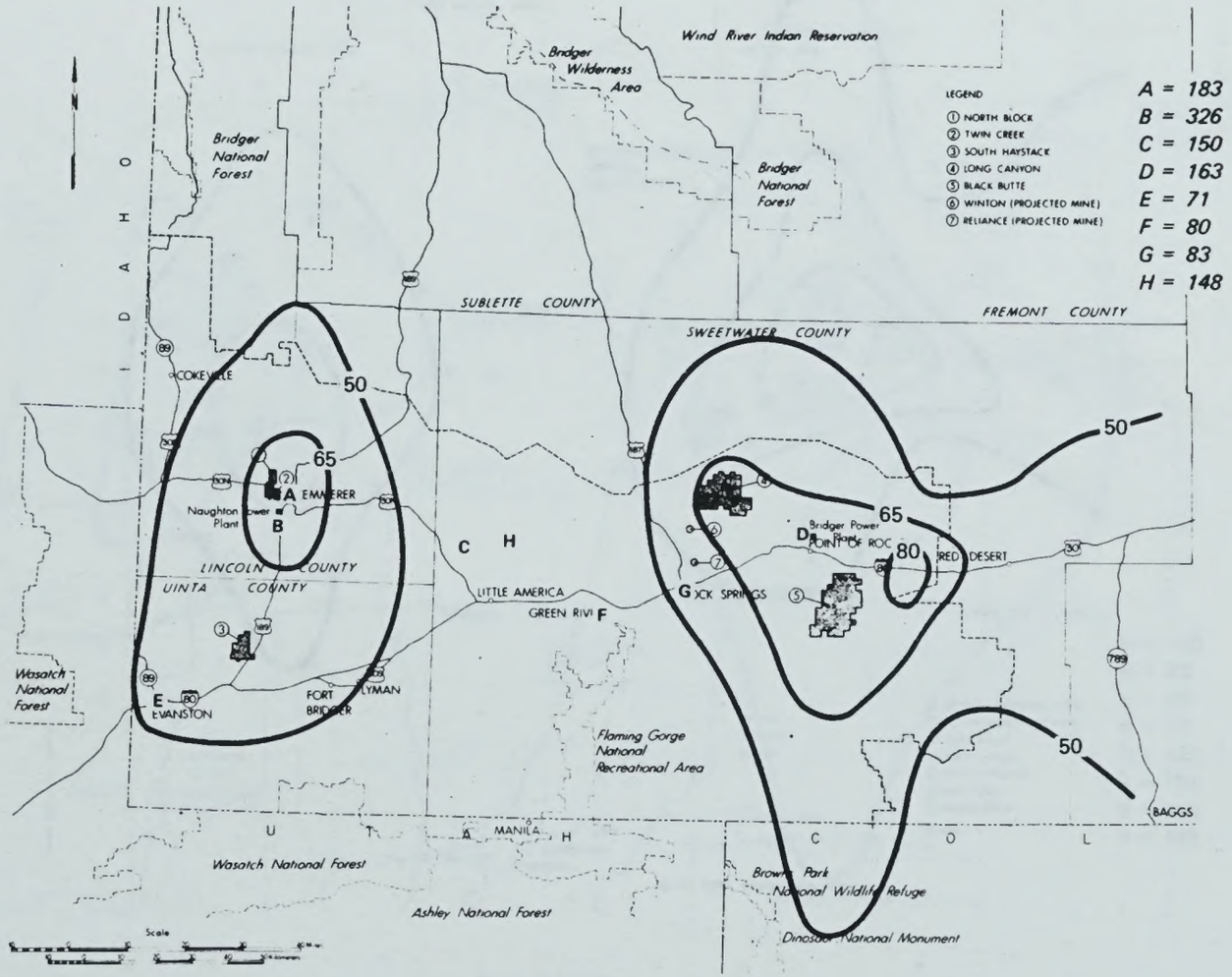
Source: ERT 1978a.



Map R4-2K

CUMULATIVE 1985 PREDICTED 24-HOUR AVERAGE TSP CONCENTRATIONS ($\mu g/m^3$)

Source: ERT 1978a.



Map R4-2L

CUMULATIVE 1990 PREDICTED 24-HOUR AVERAGE TSP CONCENTRATIONS ($\mu g/m^3$)

Source: ERT 1978a.

$\mu g/m^3$ about the Jim Bridger Power Plant. Background alone accounts for a major portion of these totals. The only mine contributing to total levels about the Jim Bridger Power Plant is Black Butte, which accounts for approximately 10 $\mu g/m^3$. The second highest background concentrations are projected to occur in the urban areas of Sweetwater County. In the vicinity of Rock Springs, total cumulative levels range from 75 to 135 $\mu g/m^3$; background alone accounts for greater than 90% of these levels. As indicated in earlier sections, maximum mine simulated concentrations of 227 $\mu g/m^3$ occur less than 2 miles south of Twin Creek. When combined with projected background, resultant total concentrations range from 277 to 302 $\mu g/m^3$. The Twin Creek and North Block Mines line up under the influence of a northerly wind flow to account for greater than 80% of these total concentrations. Emissions emanating from Twin Creek dominate the 80% mine contribution since the estimated Twin Creek emission rate is more than seven times that of North Block. In Kemmerer, located approximately 2 miles east of Twin Creek, predicted cumulative 24-hour TSP levels range between 170 and 195 $\mu g/m^3$. The Twin Creek (predominately) and North Block Mines contribute approximately 120 $\mu g/m^3$ to these levels, indicating that the contribution from background is less than 30%. Within approximately 6 miles north, south, and east of Twin Creek, cumulative TSP levels are predicted to be greater than the Wyoming 150 $\mu g/m^3$ 24-hour average standard, attributable primarily to the Twin Creek Mine. With application of the 43 CFR 118 regulations, the mine-caused violations discussed above will not occur. For example, instead of Twin Creek accounting for greater than 80% of the 277 to 302 $\mu g/m^3$, it would contribute less than 10% to the total 24-hour cumulative impacts. If any violations are monitered in the region, the measured concentration will be dominated by background rather than the strip mines.

North-northeast of the Black Butte Mine, peak mine simulations are on the order of 80 $\mu g/m^3$. When combined with rural background, cumulative TSP concentrations range from 110 to 135 $\mu g/m^3$. It is evident that emissions emanating from Black Butte comprise a major portion of these levels. Maximum mine simulations about South Haystack are also on the order of 80 $\mu g/m^3$. When combined with Uinta County rural background, total predicted TSP levels range from 110 to 130 $\mu g/m^3$ to which the South Haystack Mine contributes more than 60%. Cumulative levels about the Long Canyon Mine are low, ranging from 55 to 75 $\mu g/m^3$. Long Canyon contributes approximately 10 to 20 $\mu g/m^3$ to such levels, the remainder is attributable to rural background in Sweetwater County. Elsewhere within the ES region, cumulative TSP levels are predicted to be lower than the 150 $\mu g/m^3$ Wyoming standard and become quite low as the distance from the actual mine sites increases. At the same time, background concentrations dominate cumulative TSP levels with increasing distance from the sites, as is evident from Maps R4-2C and R4-2J.

Projected background concentrations for 1985 and 1990 are identical to 1980, with the exception of urban TSP levels in Sweetwater County. Maximum background concentrations ranging from 60 to 225 $\mu g/m^3$ are projected to occur throughout the industrial sectors of Sweetwater County. When combined with ERTAQ simulated mine contributions, cumulative TSP levels range from approximately 66 to 231 $\mu g/m^3$ in the trona patch and 80 to 245 $\mu g/m^3$ near the Jim Bridger Power Plant for both analysis years. Background alone accounts for a major portion of these totals. Black Butte (accounting for approximately 20 $\mu g/m^3$) is the only mine contributing to cumulative levels about the Jim Bridger Power Plant. The second highest background levels are projected to occur in the urban sections of Sweetwater County. In the proximity of Rock Springs, cumulative TSP concentrations are predicted to range from 65 to 120 $\mu g/m^3$ in 1985 and 57 to 157 $\mu g/m^3$ in 1990. Background alone comprises more than 85% of these levels; the Black Butte Mine primarily comprises the remaining percentage. Maximum ERTAQ simulated concentrations of 322 and 264 $\mu g/m^3$ occur less than 2 miles south of Twin Creek. When combined with projected background, cumulative levels range from 372 to 397 $\mu g/m^3$ in 1985 and 314 to 339 $\mu g/m^3$ in 1990. The Twin Creek and North Block Mines influenced by a northerly wind flow line up to account for more than 84% of such total TSP levels. Emissions emanating from Twin Creek in 1985 and 1990 are approximately three times those of North Block; and, hence, Twin Creek dominates the 84% mine contribution. In Kemmerer, located about 2 miles east of Twin Creek, ranges of 170 to 195 $\mu g/m^3$ are indicative of calculated cumulative impacts for 1985 and 1990. The Twin Creek (predominately) and North Block Mines account for 120 $\mu g/m^3$, indicating that the contribution from background is less than 30%. Within approximately a 6-mile radius of the center of Twin Creek, as depicted in Maps R4-2E and R4-2F, cumulative TSP concentrations are predicted to be greater than the Wyoming 150 $\mu g/m^3$ standard, attributable primarily to the Twin Creek Mine. The violations shown in this paragraph will not occur with application of the new 43 CFR 118 regulations, because both background and most of the particulate impacts of strip mines are a result of fugitive dust.

North-northeast of Black Butte, peak mine simulations are on the order of 120 $\mu g/m^3$ for 1985 and 1990. When combined with Sweetwater County rural background, total predicted ambient levels range from 150 to 175 $\mu g/m^3$, which is greater than the Wyoming standard but less than the NAAQS. Emissions emanating from Black Butte comprise a major portion of these totals. Second highest simulated cumulative TSP levels about Black Butte range from 110 to 135 $\mu g/m^3$, to which the Black Butte Mine contributes more than 60%. Maximum mine simulations are also on the order of 80 $\mu g/m^3$ within 3 miles about South Haystack for analysis years 1985 and 1990. When combined with Uinta County rural background, ranges of 110 to 130 $\mu g/m^3$ characterize cumulative TSP levels. The South Haystack Mine alone comprises more than 60% of these total concentrations. Cumulative levels about the Long Canyon Mine are similar to 1980, ranging from 55 to 75 $\mu g/m^3$. Long Canyon contributes approximately 10 to 20 $\mu g/m^3$ to such levels, the remainder is attributable to rural background in

Sweetwater County. Elsewhere in the ES region, cumulative TSP levels are predicted to be lower than the 150 $\mu g/m^3$ Wyoming standard, and become quite low as distance from the mine sites increases.

Blasting and coal fires are other potential sources of particulate emissions. The impact of these sources is difficult to assess, although the maximum air quality degradation would occur on a very local scale. The cloud of dust produced by blasting would be short-lived, at least compared to the averaging times of the TSP standards (24 hours or greater), so that little contribution to 24-hour levels would be measured inside or outside the mine site. The dust produced would also be initially dispersed to a greater degree by the force of the explosion. Blasting would generally take place during the day when meteorological characteristics are most favorable for dispersing ground-level pollutants. Coal fires during the life of the mines could also occur in spite of measures employed to avoid them. If neglected and allowed to burn out of control for long periods, they could significantly degrade the quality of air. Estimate of frequency or quantity of emissions cannot be made. However, fire control technology is such that potential impacts would probably be minimal.

If reclamation fails at a site due to a natural catastrophe and the area disturbed by mining operations is not revegetated, particulate emissions could be greatly increased. These impacts would be primarily local, and regional effects would be minimal. However, regionwide failure of revegetation could occur during a severe drought and, consequently, have a significant impact on ambient air quality. The frequency of severe droughts in southwest Wyoming is on the order of 3 months per year as discussed in Chapter 2. However, the assumption that mulching and planting occur in the fall is inherent in the impact results depicted in Maps R4-2A through R4-2L. Therefore, if the 3-month drought period were to occur in the fall, TSP concentrations would be higher than those described in the impact chapter. However, the likelihood of a fall drought and resultant negative effects on predicted worst-case impacts associated with mining and reclamation processes is uncertain.

Gaseous Pollutant Impacts

In general, cumulative impacts on gaseous pollutants (CO, HC, NO_2, and SO_2) are insignificant when compared to standards. Cumulative impacts on CO and HC cannot be quantified due to the lack of monitoring data. However, such total impacts are not expected to significantly differ from impacts associated with the proposed actions alone. Rural background NO_2 and SO_2 levels are quite low (less than 7% and 2% of corresponding state and federal standards, respectively) as discussed in Chapter 2. When combined with concentrations associated with the proposed actions, cumulative levels are well below NO_2 and SO_2 standards.

Indirect Air Quality Impacts

Additional air pollutant emissions would result from sources related to the proposed coal development. These indirect sources include new or expanded housing, new roadways and increased traffic, new or expanded commercial activities, expansion of existing power plants, and construction activities.

The Jim Bridger and Naughton Power Plants, situated in Sweetwater and Lincoln counties, respectively, are the only existing power plants located within the ES region. The expansion of the Jim Bridger Power Plant and the proposed expansion of the Naughton Power Plant are expected to increase particulate emissions by 25% and 20%, respectively. Emissions attributable to the remaining indirect sources listed above were based on population growth associated with mining development; population is estimated to increase by 31%, 50%, and 51% in 1980, 1985, and 1990, respectively. Therefore, ground-level TSP concentrations should increase in all areas but not in a homogeneous spatial pattern.

Quantitative impacts of the proposed mines to variations in baseline SO_2 and NO_x concentrations are unknown; however, the contributions from the proposed mines are expected to be negligible. The impact of the indirect sources listed above on baseline SO_2 and NO_x concentrations is discussed in the Chapter 2, Regional Technical Report (ERT 1978a).

Visibility

Visibility is subjectively defined as an observer's ability to perceive a distant object against its background. More quantitatively, it is the limiting distance where the threshold for contrast perception is reached for an observer viewing an ideal object. The ability of an observer to discern distant objects is constrained by the capacity of the intervening atmosphere to absorb and scatter visible light emanating from the object within the field of view. Atmospheric extinction properties and their corresponding effect on visibility degradation depend, in a complicated manner, on the optical nature of the ambient air molecules, aerosols, and particulates within the line of sight. Additional anthropogenic sources of particulates, such as those attributable to fugitive dust emissions, would reduce visibility downwind from the immediate source area.

Using the derived relationship between visibility and TSP concentrations shown in Maps R4-2A through R4-2F (found in the Chapter 4, Regional Technical Report, (ERT 1978a)), degradation of visibility throughout the ES region can be addressed. In general, isopleths of visibility and TSP are not coincident, and the derived relationship is strictly valid only for uniform aerosol distributions. It is assumed, however, that sufficiently far from particulates sources, the TSP distribution is relatively homogeneous over the distance of the prevailing visibility. Close to sources where the TSP gradient is greater, use of the visibility relationship will be valid only when the observer looks along a TSP isopleth. Visibility is overes-

timated when looking into higher TSP regions (toward the source) and underestimated when looking away from the source. Background visibilities for each year are estimated using the projected regional background TSP concentrations depicted in Table R2-2A. In conjunction with current visibility observations, regional background visibilities were determined to be 40 miles for each year. Unaccounted for factors, such as increased levels of regional sulfate or nitrate aerosols, may significantly alter the projected assumed background visibilities, and the reader is cautioned to be aware of such anomolies.

For brevity, specific aspects of the visibility degradation corresponding to the projected TSP distribution are addressed. These include the minimum visibility predicted by the maximum predicted pollutant concentrations within the region and the visibility corresponding to the predicted levels of 20 $\mu g/m^3$. An examination of the TSP maps indicates that most of the ES region has predicted TSP concentrations from fugitive dust sources less than this value. Additionally, Class I areas (Bridger Wilderness Area) and potential Class I areas (Flaming Gorge and Fossil Butte) are examined for significant degradation of visibility.

For 1980, worst-case, 24-hour SP concentrations attain values as high as 227 $\mu g/m^3$ in the vicinity of the proposed North Block and Twin Creek Mines. This corresponds to a visibility of 24 miles, when assuming a background of 40 miles. Most of the region, however, is characterized by predicted levels less than 20 $\mu g/m^3$, which corresponds to a visibility of 37.8 miles. This is a change of 5.5% from background.

Concentrations in the Bridger Wilderness Area (Class I) are about 1 $\mu g/m^3$. This level of SP yields a visibility of 39.9 miles for a reduction of less than 0.3% from the background. In the vicinity of Flaming Gorge National Recreational Area (Class II), SP values are between 2 and 4 $\mu g/m^3$, giving visibilities of 39.5 miles (visibility degradation 1.2%). At Fossil Butte, where concentrations are approximately 20 $\mu g/m^3$, the computed visibility and visibility degradation are 37.8 miles and 5.5%, respectively.

For 1985, worst-case 24-hour SP concentrations attain values as high as 322 $\mu g/m^3$ in the vicinity of the proposed North Block and Twin Creek Mines. This corresponds to a visibility of 20.1 miles, assuming a background of 40 miles. Most of the region, however, is characterized by predicted levels less than 20 $\mu g/m^3$, which corresponds to a visibility of 37.7 miles. This is a visibility degradation of 5.8% from background.

Concentrations in the Bridger Wilderness Area (Class I) are between 1 and 2 $\mu g/m^3$. This level of SP yields a visibility for 39.8 miles for a reduction of less than 0.7% from the background. In the vicinity of Flaming Gorge National Recreational Area (Class II), SP values are between 4 and 5 $\mu g/m^3$, giving visibilities of 39.4 miles (visibility degradation 1.5%). At Fossil Butte, concentrations are approximately 32 $\mu g/m^3$. The computed visibility and visibility degradation are 36.4 miles and 8.9%, respectively.

For 1990, worst-case 24-hour SP concentrations attain values as high as 264 $\mu g/m^3$ in the vicinity of the proposed North Block and Twin Creek Mines. This corresponds to a visibility of 22.1 miles, assuming a background of 40 miles. Most of the region, however, is characterized by predicted levels less than 20 $\mu g/m^3$, which corresponds to a visibility of 37.7 miles. This is a visibility degradation of 5.8% from background.

Concentrations in the Bridger Wilderness Area (Class I) are about 1 $\mu g/m^3$. This level of SP yields a visibility of 39.9 miles for a reduction of less than 0.3% from the background. In the vicinity of Flaming Gorge National Recreational Area (Class II) SP values are between 3 and 4 $\mu g/m^3$, giving visibilities of 39.5 miles (visibility degradation 1.3%). At Fossil Butte, concentrations are approximately 25 $\mu g/m^3$. The computed visibility and visibility degradation are 37.2 miles and 7.1%, respectively.

GEOLOGY

Paleontology

Impacts to paleontological resources would consist of losses of plant, invertebrate, and vertebrate fossil materials for scientific research; losses of public education (interpretative programs); and losses to other values. Losses would result from destruction, disturbance, or removal of fossil materials as a result of coal mining activities, unauthorized collection, and vandalism.

A beneficial impact of development would be the exposure of fossil materials for scientific examination and collection which otherwise may never occur except as a result of overburden clearance, exposure of rock strata, and mineral excavation.

Fossil materials of Paleocene and Cretaceous age in the Adaville, Almond, Evanston, Fort Union, Hilliard Shale, Lewis Shale, and Rock Springs Formations would be impacted to variable degrees. One hundred and thirty-nine known fossil vertebrate localities and an undetermined number of uninventoried exposed and unexposed localities would be disturbed or destroyed by mining by 1990.

All exposed fossiliferous formations within the region could also be affected by increased unauthorized fossil collecting and vandalism as a result of increased regional population. The extent of this impact cannot be presently assessed due to a general lack of specific data on such activities.

Due to the present lack of data and accepted evaluatory criteria for determination of significance, no meaningful assessment can be presently made as to the extent and nature of the loss of these paleontological values to science or education, or hence to the significance of potential impacts on the fossil record.

Geologic Hazards

In nearly all areas where it is proposed that coal be mined by open-pit and strip methods the natural slopes

are not steep. In all such areas the topography shows no typical landslide forms; i.e., the topography shows no evidence of previous landsliding. In all such areas the strata to be mined dip into the slopes. For these reasons the landslide potential of the proposed open-pit mining sites is thought to be minimal. The landslide susceptibility of the rock and earth material, however, is estimated to be high (Radbruch-Hall et al. 1976). If slopes were undercut or oversteepened, some caving or sliding could occur during periods of thawing or heavy rain.

Subsidence would occur at the Long Canyon project area, the only area where underground mining has been proposed. Here mining would be by longwall or continuous mining methods, and it is planned that the surface would be allowed to subside. Because of the mining methods that would be employed, the subsidence would be relatively uniform, major ground breakage would not be expected, and no geologic hazards at the surface are foreseen. With acceptable engineering practices, there should be no geologic hazards underground.

The ES region is in an area of low seismic activity; so, the probability of damage resulting from earthquate activity is low.

TOPOGRAPHY

The area disturbed by open-pit mining and spoil deposition by the year 1990 as a result of the proposed actions would be 11,785 acres. Of this acreage, 1,752 acres would be disturbed by 1980 and 7,443 acres by 1985. Surface facilities and other mine-related activities would disturb an additional 2,654 acres by 1980, 2,702 acres by 1985, and 3,032 acres by 1990, but this acreage, in most cases, would not be disturbed enough to affect the topography. Development of existing mines would disturb an additional 4,967 acres by 1980, 6,567 acres by 1985, and 6,700 acres by 1990, but this disturbance would not have been influenced by the proposed actions. Total topographic disturbance from both the proposed and existing coal mining activities would be 6,719 acres by 1980, 14,010 acres by 1985, and 18,485 acres by 1990, representing 0.11%, 0.22%, and 0.29%, respectively, of the total acreage of the ES region. At one site, Long Canyon, 3,680 acres in addition to the above acreage would be undermined and would subside, but the surface would not, in most places, be significantly disrupted.

At all of the open-pit sites, the topography would be radically altered. At North Block, the existing small east-trending valleys with moderately sloping sides give the land an overall aspect of an east-sloping surface with a rolling or undulating east-west grain. Upon this existing topography would be imposed a pattern of generally north-south trending steep-sided ridges and valleys with many elongate north-south trending undrained depressions.

Drainage in the disturbed area would be north and south, along the man-made valleys, to the undrained depressions or to the natural watercourses and then eastward. The positions of the natural watercourses would be essentially unchanged and their character would also be essentially unchanged except for the locations of the undrained depressions on them.

At Twin Creek, the major impact on the topography would be the burial of the existing surface to a depth of from 10 to 250 feet. The reclaimed surface on public land would be different from the natural surface in that all but the most major topographic expression would be obliterated. The mine plan shows a large pit approximately 500 feet deep and 140 acres in area that would be left open with its western limit (the highwall) being left as a series of catch benches and risers. Most of the risers would be about 80 feet high. The north wall of this pit would be left at its angle of repose of approximately 33 degrees (65%). The east and south walls would be left at slopes of approximately 18 degrees (32½%).

The two largest natural watercourses in the disturbed area would remain in approximately the same position. All tributaries to them and all other lesser watercourses would be obliterated.

At South Haystack, the lesser topographic expression would be obliterated.

The principal watercourses in the disturbed area would remain in their present locations and, in most places, would not be significantly disturbed.

At Black Butte, the land surface would, in places, be raised as much as 125 feet above its original position. In other places it would be lowered as much as 225 feet. In the reclaimed areas, all but the most major topographic expression would be obliterated.

Many of the larger watercourses would be moved, straightened, rerouted, or otherwise modified. For example, most of the natural drainage of Sections 11 and 14, T. 18 N., R. 100 W., is accomplished by three watercourses. Most of the area now drained by them would be drained by a single watercourse routed south-southwest through the western part of Section 14, which is public land. The resulting increased flow along the lower reaches of this watercourse would probably cause increased downcutting of the stream bed. All the lesser watercourses and all the tributaries to the major watercourse in the mined area would be obliterated.

At Long Canyon, there would be little visible effect on the land surface as a result of the proposed mining, because all mining would be underground using longwall or continuous mining methods. The principle effect on the topography would be that of subsidence. Because the mining would be relatively near-surface (200 to 900 feet), the amount of subsidence would probably equal a significant fraction of the total thickness of the beds mined, which ranges from 4 to 40 feet. Also, because there are many variables involved, the individual thickness of the four mineable coal beds and of the overburden plus the possible degree of expansion of the overburden, it is difficult to estimate with accuracy the amount of subsidence that would occur at any given place; however, a top limit would be approximately 30 feet. The area subject to subsidence would be 3,680 acres.

Because the proposed mining would be underground at Long Canyon, the land surface would be essentially undisturbed except for subsidence, and all watercourses would remain in their present positions. Their gradients

would be increased in the eastern part of the proposed mining area where increased downcutting could be expected, and their gradients would be decreased in the western part where deposition would be likely. Subsidence probably would not be great enough to cause ponding of any of the streams.

Roads and railroads might cause gullying through increased erosion because of the channelization of drainage water. Also, utility lines, if buried, could cause increased erosion and gullying because of the resulting devegetation and the disturbance of the soil and rock material to a depth of several feet.

SOILS

The proposed mining would significantly disturb and alter the soils on 11,785 acres within the region by 1990 (Table R4-5A). The disturbance primarily represents areas proposed for mine pits and spoil storage. On these areas topsoil would be removed, handled, and in some cases stockpiled. These processes would destroy the soil structure and lower the soil biota population. The subsoil would be removed by mining and mixed with the spoil; therefore, all subsoil characteristics would be lost.

An average of 1,091 acres of soil surface would be disturbed per year as a result of the proposed actions. The yearly disturbance also includes acreage reclaimed after reclamation starts. An accelerated rate of soil erosion from water action would occur on areas being reclaimed. The average amount of soil movement on these areas would be approximately 8.5 tons per acre per year (calculated using Musgrave's Equation, Bureau of Land Management (BLM) Manual 7317.22A). This is an increase of 3.5 tons per acre per year over the present rate. Some of this soil would be lost from the areas being reclaimed, and some could end up increasing the sediment load in the Hams Fork. The amount of soil erosion would decrease as vegetation became reestablished. An increased rate of wind erosion would also occur over the exposed areas as a result of mining (vegetative cover removed and not reestablished). The soil lost (entering atmosphere) over these disturbed areas would total approximately 1,724.5 tons per year after full operation. Thus would represent an increase of 1,364.5 tons per year over the present rate. This value only represents the surface mines, since wind erosion over underground mines would not significantly increase.

In the future, soil disturbance would occur from construction and expansion of noncoal-related activities (see Table R1-6). Due to the nature of the disturbance, with reclamation efforts there will not be a significant (or lasting) reduction in soil productivity. Expansion of existing surface coal mines in the future would result in major disturbance of those soils associated. This disturbance would alter soil characteristics and result in a short-term reduction in soil productivity on 6,700 acres of soil by 1990. An accelerated rate of erosion would occur from wind and water on areas of disturbance.

Future population increases in the region would result in the removal of about 1,350 acres of soil surface by 1980, of which 350 acres would result from the proposed actions; about 2,250 acres by 1985, of which 750 acres would result from the proposed actions; and about 3,100 acres by 1990, of which 1,100 acres would result from the proposed actions. This permanent loss of soil surface would result from the construction of housing and support facilities. Also, the increase in population would result in greater use of the region's soils for recreation, particularly off-road vehicles. Greater off-road vehicle use would result in increased soil compaction in the localized areas of use and an accelerated rate of soil erosion. The loss in the soil resource as a result of increased off-road vehicle use resulting from the proposed actions is not quantifiable. There would be an increase in off-road vehicle use without the proposed actions; however, the amount is also not quantifiable.

The overall result of the proposed actions with continuation of existing mines in the region would be a short-term reduction in soil productivity on 18,480 acres by 1990. Soil productivity would be reduced on 6,750 acres by 1980, of which 1,783 acres would result from the proposed actions; on 14,026 acres by 1985, of which 7,459 acres would result from the proposed actions; and on 18,480 acres by 1990, of which 11,785 acres would result from the proposed actions. This reduction in soil productivity would result from major alteration of the soils in removing, handling, stockpiling, and from the soil loss that would occur from wind and water erosion. The short-term reduction (less than 10 years) in soil productivity resulting from the proposed actions would occur on 11,780 acres by 1990, which is less than 1% of the region's soils (approximately 6.3 million acres).

WATER RESOURCES

Withdrawals in the southwestern Wyoming coal region were approximately 1,329,821 acre-feet in 1976. By 1990, annual withdrawals would increase by 86,351 acre-feet, 5,040 acre-feet of that increase would be due to the proposed actions.

Ground Water

Mining would interrupt some alluvial and bedrock aquifers. By 1990, 1,593 acres (less than 0.4% of the region) would be disrupted. Backfilling would not completely restore the aquifers. Where the volume of overburden is small compared to the volume of coal removed, leaving little material with which to backfill the pit, a depression would remain that could fill with water, forming an ephemeral pond or lake.

During mining, water levels would be lowered near the mines that intersect aquifers. Cyclic pumping of wells supplying individual mines would lower water levels in aquifers tapped by less than 1 foot at a distance of 1 mine from the pumped well. The extent of water level lowering would depend on aquifer geometry, aquifer properties, rate of pumping, and the length of time pumping occurs. Because of interbedded shale, water in some of

Table R4-5A

SOILS DISTURBED BY THE PROPOSED ACTIONS IN THE ES REGION

Map Unit Design[1]	Map Unit Name	Acres Disturbed by 1990
1B	Shallow, loamy and clayey, alkaline association	7,038
1F	Shallow--rockland association	120
1G	Fine, saline association	142
2A	Loamy, shallow association	1,162
2B	Shallow, loamy--rockland association	2,950
2D	Shallow, loamy--rock escarpments association	361
4A	Loamy, poorly drained association	12
Total		11,785

[1]The locations and further details on the above soils can be found on the Regional Soils Map, Appendix A, and in Supporting Data-Soils, Appendix B, respectively.

the aquifers may be perched so the base of those aquifers and not the bottom of the mine would be the discharge point to which the new water level gradient would adjust. Some small, perched aquifers may be drained by mining. Water contained in mined coal beds would be lost. Interruption and dewatering of aquifers would lower water levels in nearby wells and reduce or stop discharge of springs, and seeps, and flow of streams in the vicinity of mines. This would reduce the supply available for domestic and stock use. Should this happen, the mining company must replace water lost.

Coal mining near streams that were gaining water from ground-water discharge during premining conditions would cause a reversal of ground-water gradient due to dewatering at the mine, and water could move toward the mine instead of toward the stream. If a good hydraulic connection exists between water in the stream and the underlying aquifer, downstream flow could be decreased because of mine dewatering. A reduction in streamflow could have a serious impact on aquatic life and vegetation dependent on that streamflow. Hams Fork (in the North Block and Twin Creek project areas) is the only such stream that could be so impacted. Another result of lower ground-water levels would be that owners of wells would have to drill deeper to obtain water, an economic as well as hydrologic impact.

Mining operations would also alter the ground-water recharge and discharge relationship by creating new recharge or discharge zones and by changing the slope of the water table, which would cause the aquifer to drain toward the mine. If flash floods occurred, a mine could become partly filled with water, causing water to flow into the aquifer for a time. Subsequent dewatering of the mine to resume operation would again reverse the slope of the water table so that the water which was recharged to the aquifer would be removed.

After an area is reclaimed by partly or completely backfilling the pit, an opportunity would exist for exchange of water between aquifers which were not connected before mining but are now connected through the saturated mine fill. Flow between aquifers would locally decrease the head differences that existed before mining, but the change would probably be insignificant when considering the total aquifer system. Premining recharge and discharge conditions in a mined area would not be restored by reclamation because of disruption of aquifers. Where surface depressions extend below the water table, discharge from the aquifer would be greater than before mining, but where the depression remains above the water table, recharge would be enhanced from natural ponding of surface runoff.

Backfill may, at first, have higher porosity than the original material, but permeability would decrease because the backfill is more thoroughly mixed than the original material. Where local recharge occurred before mining, destruction of existing drainage patterns may, for a time, increase recharge by ponding water in the fill area. Natural compaction of backfill would occur with time, and permeability would decrease; recharge through the new drainageways would also decrease with time.

Ground Water Quality

The pollution of ground water in the vicinity of a mine in this region generally would occur in the part of the water-bearing bed that lies between the mine and the place of natural discharge from the bed. In the case of coal and associated rocks, neither of which is very permeable, the principal point of natural discharge may be some distance from the mine. Samples from some of the wells in the area indicate that water occurring in coal beds and associated rocks is similar in concentration and composition to the water from mine pits. Similarity between these waters occurs because the water derives its soluble material from contact with the same part of the same geologic formation; the source of the water in the mine pits is a combination of normal ground water in the formation, surface runoff from the mined area, and ground water which has moved through the spoils. The similarity between water in the pits and nearby ground water indicates that, locally at least, leaching of soluble material from the spoils material does not materially degrade the water that accumulates in the pits. In such areas, water from the mines cannot be considered to be polluting the ground water, since it is causing no appreciable change in the ground water composition.

The low sulfur content of coal to be mined and the small amount of precipitation in the area reduce the likelihood of sulfuric acid forming in mine pits or percolating into the ground water.

Water from mine spoil is not acid. It may be slightly higher in dissolved solids than the water from undisturbed overburden. Mine spoil water is predominantly a calcium sulfate type water with lesser amounts of magnesium, sodium, and bicarbonate. Any leaching of spoils is accelerated during the period preceding reclamation. At this time the surface of the spoils is fairly permeable, and there is no vegetation to utilize the precipitation falling on the spoil surface. These factors contribute to a temporary increase in recharge to ground water.

Use

Probably the largest impact on ground water other than interruption of an aquifer by mining would be withdrawals for mining operations such as dust control, vehicle washing, showers for workers, drinking water, and sanitary facilities. However, because the individual mines are considerable distances apart and because the proposed activities require little water, the regional impact on the total ground-water resource would be insignificant.

The projected water requirements for various ground-water and surface-water uses until 1990 are shown in Tables R4-6A and R4-6B. How much of this additional demand would be met from ground-water or surface-water sources cannot be predicted with certainty; however, because the largest population growth would be at present population centers that now use surface water, probably most of the demand would be met by using surface-water sources.

Table R4-6A

ESTIMATED WATER WITHDRAWAL IN 1980, 1985, AND 1990
WITH PROPOSED ACTIONS
(IN ACRE-FEET)

	1980	1985	1990
Public supplies			
Domestic	12,300	14,200	14,400
Commercial and industrial	7,510	8,690	8,760
Rural use			
Domestic	961	1,050	1,060
Livestock	4,780	4,780	4,780
Irrigation	1,210,000	1,210,000	1,210,000
Industrial, self-supplied			
Coal mining	665	806	806
Trona mining	119,000	119,000	119,000
Thermal-electric power plants	48,800	56,500	56,600
With proposed action coal mines	544	766	766
Total	1,404,561	1,415,792	1,416,172

Table R4-6B

PROJECTED CHANGES IN WATER USE
IN SOUTHWESTERN WYOMING
(BASE YEAR IS 1976)

	1980		1985		1990	
	Acre-Feet	%Change From 1976	Acre-Feet	%Change From 1976	Acre-Feet	%Change From 1976
Change in water use without proposed actions	+71,874	+5.40%	+80,934	+6.09%	+81,311	+6.11%
Change in water use with proposed actions	+74,740	+5.62%	+85,792	+6.45%	+86,351	+6.49%
Difference between no action and proposed actions	+ 2,866		+ 4,858		+ 5,040	
Percent increase from no action		+3.99%		+6.00%		+6.20%

Surface Water

Use of unappropriated surface water for coal development and associated uses would have varying environmental impacts. More than 800,000 acre-feet per year are available for appropriation for beneficial use from the office of the Wyoming State Engineer under the terms of the Upper Colorado River Basin Compact of 1948. More than 100,000 acre-feet per year of this water are available for sale for beneficial use through the office of the Wyoming State Engineer. Municipal and industrial users may attempt to ensure firm supplies by buying or constructing storage capacity to meet their anticipated needs. Construction of storage and diversion works would have increased impact on fisheries, recreation resources, agricultural land use, and aesthetics. The quality of water in the Lower Colorado River Basin has deteriorated in historic times and any upstream diversions would cause further deterioration.

Mining would impact streamflow characteristics. The annual and low flows of the streams would be increased by the release of water pumped from the mines or by release of waste water from industrial plants. Peak flows would not be affected except in the small tributaries draining the developments. Mining would cause alteration of various small tributary stream channels such as Bitter Creek and Cedar Canyon. These alterations could cause significant general and local effects on the geomorphology and hydraulics of the area's stream systems. Construction areas are highly susceptible to erosion. Introduction of large amounts of sediment into a stream would cause local aggradation which would steepen the channel and increase flow velocities, thereby causing instability of the stream at that site. Secondly, channelization could change the base level of the stream, and intervening tributaries would have to adjust to a new slope condition. As this adjustment takes place, head and downcutting of the tributaries could result in significant erosion of the watershed. Because headcutting of channels is a condition that moves upstream, the entire watershed of an intervening tributary could be affected by the alteration of a main channel.

Decreased permeablility of the reclaimed overburden could result in lower infiltration rates, thus annual and low flows of the interrupted streams could be increased. On the other hand, if the mined areas were to be reclaimed so that a lake is formed, peak flows as well as annual runoff could be reduced.

Surface Water Quality

The amount of dissolved solids in streams below areas of development would increase during mining and reclamation. Dissolved solids in water discharged from development areas would contribute to existing stream loads. Increased dissolved solid loads in streams can be expected from runoff from newly exposed surfaces.

Change in concentration of dissolved solids in the streams would depend upon the amount of water and dissolved solids discharged by the mine and its relation to the amount of water and dissolved solids in the streams at the time. Evaporative concentration of dissolved solids in the mixture of water would occur as it flows downstream. Greater effects would occur during periods when a larger portion of the water in the stream is received from development areas. Precise changes in concentrations of dissolved solids in surface water cannot be predicted at present. Further studies, including applied research and monitoring, are needed.

Discharged waste water may include fecal bacteria, petroleum products, detergents, and solvents which, if allowed to discharge directly or indirectly to the stream through settling ponds or runoff, would decrease the quality of downstream water. Data are not available to assess the impact that sewage effluent would have on stream-water quality in the coal basin if the effluent were released directly to streams. However, EPA and state regulations allow no decrease in quality of water at the point of discharge of any effluent to a stream. Current policy in Wyoming is to prohibit discharge of water containing more than 789 mg/l of total disolved solids to the Colorado River Basin.

Sewage treatment plants commonly handle an amount of sewage equal to about 80% of volume of water pumped as supply. Thus, the following is the total estimated sewage effluent expected for the selected time frames: 1980—15,800, 1985— 18,300, and 1990—18,500 acre-feet per year with proposed actions; 1980—14,000, 1985—15,000, and 1990—15,200 acre-feet per year without proposed actions.

The Wyoming Department of Environmental Quality requires that body contact be restricted in waters containing coliform counts higher than 200 colonies per 100 milliliters on class 2 streams. Any increase in sewage effluent at the same treatment level as 1975 would result in increased coliform count, thus indicating a higher level of pollution than presently exists. The hazard to life and health would increase as pollution levels increase at downstream points in Bitter Creek and Green River.

An obnoxious odor from the present Rock Springs sewage treatment plant is noticeable at times in the western part of Rock Springs and in the vicinity of Blairtown. The miasma is particularly apparant on warm summer days when little or no air movement occurs. At present sewage treatment levels, this situation would occur more frequently.

Sediment concentration in streamflows may be increased by runoff from disturbed areas. Disturbed areas would include spoil piles, areas denuded by construction, and channelized stream courses. Due to the relatively small areas of the disturbances, change in sediment quantity would be mainly local.

Changes in surface water quality after reclamation is completed would be indicative of success in the reclamation effort. Surfaces left unprotected from erosion would continue to contribute dissolved solids to streamflow at higher than normal concentration. Sediment quantity would depend upon erosion. Evaporation would cause an increase in the total dissolved solids in water in pits remaining after reclamation.

VEGETATION

Terrestrial

The proposed actions would result in the removal of vegetation, changes in vegetation types upon reclamation, and the loss of vegetative production for varying periods of time on approximately 4,756, 10,895, and 15,917 acres by 1980, 1985, and 1990, respectively (Table R4-7A). Approximately 0.25% of the region's surface acreage would be disturbed by 1990. (Acreages of disturbance include estimations for housing, etc., due to increased population.) Additional disturbance of vegetation would occur due to increased outdoor recreation. The reclamation of disturbed lands would generally be conducted concurrently with mining, with about 341 acres reclaimed by 1980, 3,334 acres by 1985, and 8,871 acres by 1990.

The revegetation of mined areas would be difficult due to many factors (Cook, Hyde, and Sims 1974, Bleak et al. 1965, May 1975, and Thames ed. 1977). Climatic conditions are severe with a lack of moisture probably being the most limiting factor (May 1975). The primary use of bottom sites for topsoil acquisition, due to thin or nonexistent topsoil horizons on other sites, could result in the use of soils with high salt content. This could occur due to the inability of operators, with existing machinery (such as scrapers), being unable to precisely strip the better soil horizons on such sites. Such salts restrict the growth of nonsalt-tolerant plants and make plant reestablishment difficult (May 1975). Seeds of secondary succession species have been found in topsoils of mined areas in Wyoming (May 1975). The germination of these plants would result in competition to seeded plants for moisture and nutrients (James and Cronin 1974 and Klingman 1961). Rodents have caused problems on revegetated areas by consuming seeds and by girdling and (or) cutting seedlings (Thames ed. 1977). The mining and reclamation plans of the proposed mines present methods and procedures designed to minimize the numerous problems in reestablishing vegetation on semiarid mined lands. These include such practices as mulching, surface manipulation, biological and chemical control of weedy plant species, plant species suitability trials, and irrigation feasibility studies.

The seed mixtures and limited shrub and tree transplanting techniques proposed in the mining and reclamation plans would result in reclaimed areas having a general aspect of grassland. Extensive shrub and forb reestablishment would require natural plant succession. Cook (Vories ed. (1976)) suggested a period of 30 to 50 years for native plant reestablishment.

Reclamation of mined and nonmined disturbed areas would require an estimated 9 and 8 years, respectively, to fulfill 43 CFR 715.20(f) revegetation requirements. (Living plant ground cover of reclaimed areas would be equal to reference areas for 2 growing seasons.) (See the vegetation sections, Chapter 3s, site specifics for discussions concerning a lack of conclusive data proving the reclaimability of lands proposed for mining and the reclamation alternatives in the Chapter 8s, site specifics. The alternatives identify a procedure to prove the feasibility of on-site reclamation.)

The proposed actions would contribute from 22% to 25% of the total estimated disturbance to vegetation within the region by 1980, 1985, and 1990. (See Table R4-7A for vegetation type disturbance and Table R1-6 for kinds of other disturbance within the region.) The short- and long-term losses of vegetative cover and production from the proposed actions and other activities would affect numerous living and nonliving components of the environment (see other sections in this chapter).

Aquatic

Data are lacking with which to quantify impacts from the proposed actions and other activities to algae and other aquatic vegetation present in seasonal drainages.

Endangered and (or) Threatened

Vegetative surveys by Dorn (1977 and 1978) did not reveal the presence of any endangered and (or) threatened plant species on any of the proposed coal mining areas. The process for requesting formal consultation under Section 7 of the Endangered Species Act of 1973 was initiated for North Block with the U.S. Fish and Wildlife Service on 2 March 1978.

The U.S. Fish and Wildlife Service responded by letter dated 7 March 1978 that formal consultation cannot be conducted for unlisted species.

FISH AND WILDLIFE

Impacts of the proposed actions upon fish and wildlife resources are summarized in Tables R4-8A, R4-8B, and R4-8C. Impacts can be categorized into three general types: (1) loss of fish and wildlife habitat, (2) loss of the carrying capacity of that habitat to sustain fish and wildlife populations, and (3) loss of the fish and wildlife population and their progeny over the period of mining and reclamation.

Habitat Losses

Table R4-7A in the Vegetation section shows the disturbance of the vegetation types: sagebrush, saltbush/greasewood, and all others combined at the years 1980, 1985, and 1990. Most (80%) of the disturbance would take place upon shrub ecosystems which supply habitat for a majority of the wildlife species in the region. The proposed actions would account for the direct losses of 22%, 25%, and 24% of the total disturbance for 1980, 1985, and 1990, respectively. Other activities would account for the direct losses of 78%, 75%, and 76% of the total disturbance for 1980, 1985, and 1990, respectively.

Table R4-7A

VEGETATION TYPE DISTURBANCE IN SOUTHWESTERN WYOMING ES REGION
(IN ACRES AT THREE BENCH MARK DATES)

Activity	Sagebrush	Saltbush/ Greasewood	Others Combined	Total Acres	Percent Distrubance
Proposed actions	2,848	1,238	670[2]	4,756[3]	22
Other activities[1]	11,089	2,688	3,025	16,802	78
1980 total	13,937	3,926	3,695	21,558	100
Proposed actions	6,774	3,030	1,091[2]	10,895[3]	25
Other activities	22,012	5,336	6,004	33,352	75
1985 total	28,786	8,366	7,095	44,247	100
Proposed actions	9,786	4,932	1,199[2]	15,917[3]	24
Other activities	32,495	7,877	8,863	49,235	76
1990 total	42,281	12,809	10,062	65,152	100

[1] See Table R1-6 for kinds of activities; disturbance by vegetation types assumed for other activities.
[2] Includes wet meadow winterfat, mountain shrub, aspen, and grassland vegetation types.
[3] Includes estimated acreage disturbance for housing and support facilities needed for increased population.

Table R4-8A

SUMMARY OF IMPACTS ON FISH AND WILDLIFE RESOURCES FROM THE PROPOSED ACTIONS

Classification of Impacts	Anticipated Impact of Proposed Actions on Area Directly Involved			Percent of the Impact of the Proposed Actions to the Total Cumulative Impacts
	None	Minor	Major	
1. Fish and wildlife habitat			X	24
2. Carrying capacity for fish and wildlife			X	24
3. Fish and wildlife populations				
A. Fishery				
1. Nongame		X		*
2. Game		X		*
3. Endangered and (or) threatened species	X			0
B. Wildlife				
1. Birds				
A. Nongame			X	24
B. Game			X	24
C. Endangered and (or) threatened species	X			0
2. Mammals				
A. Nongame			X	24
B. Game			X	24
C. Endangered and (or) threatened species	X			0
3. Reptile and amphibians				
A. General			X	24
B. Endangered and (or) threatened species	X			0

*Insufficient data to determine at this time.

Table R4-8B

A SUMMARY AND COMPARISON OF THE FISH AND WILDLIFE AREA IMPACTED BY THE PROPOSED ACTIONS COMPARED TO THE TOTAL CUMULATIVE ACTIONS

	Proposed Actions		Total Cumulative Actions	
	Direct Loss (Acres)	Indirect Loss Or Adversely Affected Area (Acres)[1]	Direct Loss (Acres)	Indirect Loss Or Adversely Affected Area (Acres)[1]
Fish and wildlife habitat				
Year 1980	4,756[2]	21,402	21,558[2]	97,011
Year 1985	10,895[2]	49,028	44,247[2]	199,111
Year 1990	15,917[2]	71,626	65,152[2]	293,184
Area of fish and wildlife carrying capacity affected				
Year 1980	4,756[2]	21,402	21,448[2]	97,011
Year 1985	10,895[2]	49,028	44,247[2]	199,111
Year 1990	15,917[2]	71,626	65,152[2]	293,184
Area in which fish and wildlife populations would be affected				
Year 1980	4,756[2]	21,402	21,558[2]	97,011
Year 1985	10,895[2]	49,028	44,247[2]	199,111
Year 1990	15,917[2]	71,626	65,152[2]	293,184

[1]Data are insufficient at this time to determine the degree to which these areas of influence would be affected; it may be only slightly (10%-20%) or totally (100%) depending upon the individual species involved.

[2]Totally (100%) affected.

Table R4-8C

SUMMARY OF THE FISH AND WILDLIFE POPULATION LOSSES

	Estimated Number of Individuals Directly Lost to Proposed Actions				Estimated Number of Individuals Lost Due to Other Activities Not Related to the Proposed Actions				Estimate of Total Cumulative Losses			
	1980	1985	1990	% of Total Regional Population**	1980	1985	1990	% of Total Regional Population**	1980	1985	1990	% of Total Regional Population**
Fishery												
Nongame	---	---	---	---	---	---	---	---	---	---	---	---
Game	---	---	---	---	---	---	---	---	---	---	---	---
Wildlife												
Birds												
Nongame*	8.3T	59.5T	112.4T	<0.1	45T	230T	340T	<0.1	53.3T	289.5T	452.5T	<0.1
Raptors	---	---	1.2T	***	---	---	---	***	---	---	1.2T	***
Game	1.5T	4.8T	8.2T	1.5	550	2.7T	4T	0.5	2.05T	7.5T	12.2T	2.0
Mammals												
Nongame	1.2M	7.7M	13.5M	<0.1	2.23M	11.5M	16M	<0.1	3.4M	19.2M	29.5M	<0.1
Game												
Antelope	165	685	1.37T	1.0	300	900	1.4T	2.0	465	1.6T	2.77T	3.0
Deer	200	540	850	1.0	250	800	1.3T	1.0	450	1.34T	2.15T	2.0
Elk	65	100	160	0.7	---	---	---	---	65	100	160	0.7
Moose	---	---	20	0.1	---	---	---	---	---	---	20	0.1
Reptiles and amphibians	25T	90T	125T	<0.1	37T	184T	271T	<0.1	62T	274T	400T	<0.1

*All nongame birds except raptors.
**This figure represents the relationship between the numbers of animals lost to the total regional population and is expressed as a percentage.
***Insufficient data to determine total regional population.

T = Thousands
M = Millions

Actual acreage directly lost to the proposed actions would range from 4,756 acres in 1980 to 15,917 acres in 1990. All acreage anticipated to be lost are summarized in Table R4-8B. Because reclamation would take place simultaneously with mining, not all this acreage would be lost to wildlife habitat at one time.

Reclamation efforts would take place on 341, 3,334, and 8,871 acres by 1980, 1985, and 1990, respectively. This reclamation would have varying degrees of value to wildlife depending on the wildlife species involved, the plant species used, and the success of revegetation. Reclamation, however, would be difficult in southwest Wyoming because of soil and climatic conditions (see Vegetation section). Reclamation, if successful, would be most effective for wildlife species not dependent on shrub ecosystems for survival, such as graminivorous (seed eating) rodents and birds. Populations of these types of wildlife may return to premining levels or higher if successful establishment of vegetation is achieved. Although populations may be at premining levels, the number of different wildlife species would be greatly reduced, since the complexity of the plant community would also be reduced.

Reclamation would be least effective for wildlife species which are dependent on shrub communities such as sage sparrow, sage thrasher, sagebrush vole, sage grouse, mule deer, and antelope. Shrubs seem to be extremely difficult to establish in southwest Wyoming. Populations of sage sparrow, sage thrasher, and sagebrush vole would probably not return after successful reclamation. Mule deer and antelope would probably use revegetated areas during spring and fall, but premine population levels probably could not be maintained.

Successful reclamation would be beneficial to certain wildlife species by creating "edge effect" Edge effect means that wherever two habitat types come together, the edge between the two types will be more favorable as wildlife habitat than either type considered alone. Some wildlife species would use undisturbed shrub community for cover and the reclaimed areas for feeding.

Successfully revegetated areas may be used extensively by raptors because of relatively high small mammal densities and the lack of escape cover.

In summary, if successful reclamation occurs, it would be highly beneficial to certain seed and grass eating species, somewhat beneficial to other wildlife species, and of no benefit to wildlife completely dependent on shrub communities. It is not possible to quantify the affects of reclamation on these wildlife populations; therefore, the estimated losses do not reflect any post-reclamation return in population numbers. The impact analysis to wildlife should be considered the worst-case situation, and that reclamation could have some mitigating value. It is possible, however, that only invasion of native plants and natural succession over many years (50 to 100) could fully replace the complex plant community.

In addition to the area that would be directly lost or impacted, there would exist an area (area of influence) that would be indirectly lost or affected. This "area of influence"would be indirectly lost or affected due to the fact that all living organisms to some degree exhibit a home range or territory and daily or seasonal migration. Hence, if an organism is impacted upon part of that home range or territory, the remaining part of that home range or territory is also impacted to a certain degree. This degree of impact can range from a slight impact of 10% to 20% or to a total impact of 100%, depending upon the individual organism or species involved. This area of indirect loss or adversely affected fish and wildlife habitat would range in size from an area equal to the direct habitat loss for such species as a leopard frog to four or five times the area directly affected for such species as the golden eagle. The average area of influence used in calculations was 4.5 times the actual acreage loss "in this area of influence"as summarized in Table R4-8B.

There would also be indirect effects upon fish and wildlife resources due to increases in human population. More people would spend their leisure time in the country, both on and off the roads. Motorcycles, snowmobiles, and four-wheel drive vehicles would all contribute to fish and wildlife disturbance.

Illegal hunting and demand for legal recreational use of wildlife would increase. Legal hunting could be controlled by the local wildlife law enforcement agency, but illegal shooting would increase proportionately with the human population.

In summary, increased human population would be expected to have significant impacts to the fish and wildlife populations through harrassment, off-road vehicle use, and illegal shooting.

Carrying Capacity Losses

As a result of the loss of the fish and wildlife habitat (vegetation and living space), there would exist a loss of that area's ability to support fish and wildlife population. This ability to support fish and wildlife population is known as its "carrying capacity" The loss of this carrying capacity would range from 4,756 acres (area directly affected) in 1980 to 71,626 acres (area of influence) in 1990; this loss would be reduced by the amount of land reclaimed as mining progresses. The acreages on which carrying capacity loss would occur are summarized in Table R4-8B.

Fish and Wildlife Population Loss

Introduction

There would be a loss of wildlife populations within the area to be disturbed. For example, if there are five animals per acre in a given area, and 1,000 acres of that area are disturbed, loss to that population would be 5,000 individuals. In addition, there would be a loss of the populations progeny (offspring) over the period of disturbance. The following is an example of how total population losses were determined.

The formula that was used to determine the biotic potential of small birds and mammals over the period of mining follows:

Bp = kyear (x) fecundity rate (x) Do (x) area.

Where:

Bp = biotic potential for a species or group of species. (Biotic potential, as defined here, is the maximum number of animals that could be produced in a given area over a given period of time using the basic assumptions listed below.)

Kyear = number of years for which Bp is needed.

Fecundity rate = average number of young produced per female per year.

Do = density of females per unit area in each habitat type (or average over several habitat types).

Area = average size (usually acres) of habitat type or types.

Assumptions:

1. Sex ratio = 50% males and 50% females.
2. Average annual fecundity rate is independent of habitat type for a group of animals. (Fecundity is defined as the average number of offspring resulting from one female per year. This includes the average number of offspring that her offspring would produce in that year.)
3. No mortality occurs while reproduction is taking place.
4. Population is stable (no catastrophic events or population explosions).
5. Closed population—no immigration or emigration.
6. Considering only a few of the most common species.

Example problem:

Species = deer mouse
Kyear = 20
Fecundity rate = 12 per year
Do = 2
Area = 1,000 acres
Bp = 20 (x) 12 (x) 2 (x) 1 (x) 1,000
Bp = 480,000

In this sample problem, using the above assumptions, 480,000 is the number of deer mice that could be produced in 20 years on 1,000 acres had mining not taken place.

Population growth using this formula is purely theoretical and does not occur in a natural environment. Population growth and size are controlled by many environmental factors such as food, water, cover, climate, predation, and disease. When discussing population dynamics, these factors are expressed as mortality rates.

This method does not consider mortality rates which are substantial for these highly productive small bird and mammal populations (published mortality rates for small bird and mammal populations are rare and not available for southwestern Wyoming). This explains why some of the figures seen later in this section will be quite large. The primary purpose of this formula is to give a relative idea of the potential loss of productivity in a specific area if mining proceeds.

Big game population productivity was calculated by using the average annual birth rate and multiplying it by the number of years the habitat is out of production, the animal density, and the size of the disturbed area.

Example:

Species = mule deer

Birth rate = 30% per year
Density = 5 per square mile
Disturbance area = 2 square miles
Time out of production = 5 years

2 square miles x 5 deer per square mile = 10 deer initially lost.

10 deer x 30% birth rate = 3 deer per year produced.

3 x 5 years out of production = 15 deer.

15 deer produced 10 deer initially lost = 25 deer that the area could have supported had mining not taken place.

Basic assumptions:

1. Population is stable (annual birth rate = annual mortality rate).
2. All habitat is at carrying capacity; therefore, all displaced animals would be lost.

Acres of habitat loss will be included in the discussion of big game population impacts in order to emphasize the relationship between the animals and their habitat and to put losses in perspective.

Sage grouse population losses were calculated the same as big game but using different birth rates and densities. It was assumed that the population remained stable and completely turned over about every 2.75 years.

Production of reptile and amphibian populations was determined using the following simple formula: Time out of production x current population divided by 3.

When estimating losses to the wildlife resource, it was assumed that all habitat would be at carrying capacity for the particular species being discussed. This would not, of course, be the case, and it is realized that not all the wildlife occupying an area to be disturbed would be lost. However, definitive data concerning habitat condition and trend in and around proposed project areas were not available; therefore, projections as to the survival of displaced animals were not made.

To place in perspective the numbers of wildlife individuals lost, as listed in each of the following wildlife sections, they must be viewed in their relationship to total populations and assumptions of progeny for the region.

Given the same assumptions of population densities, replacement (turnover), and progeny which would be produced over the analysis period, comparisons of individuals lost to regionwide projects would indicate that a very small percentage of the total regional population would be affected. This percentage would vary from those with limited habitat in the region (e.g., elk) to those whose habitat include virtually the entire region (e.g., deer mouse).

Fishery

There would be nonquantifiable impacts to the fishery which would not be directly caused by surface mine disturbance. The proposed actions, other activities not related to coal development, and resultant increases in human population would place demands on water supply. Fish

populations would be impacted from increased sedimentation from off-road vehicle use and decreased streamflows and reservoir levels from increased use of water and increased recreational use such as fishing.

Nongame. No impacts to the nongame fishery would occur as a result of mining, since no sediment would be released into the Hams Fork. There would be infrequent storms, however, which would cause runoff to exceed the capacity of the sediment ponds and result in sedimentation of the Hams Fork. This could affect the fish populations through gill abrasion, covering of benthic organisms, and loss of space in pools. The numbers of fish or the area of stream affected cannot be estimated without a more precise data.

Game. See nongame above.

Endangered and (or) Threatened. It is not anticipated that there would occur any adverse impacts to any endangered or threatened fish species of any type in the region (see Chapter 2, discussion of endangered and (or) threatened fish). Under Section 7 of the Endangered Species Act of 1973, the Secretary of the Interior will grant no approval which would jeopardize the continued existence of any endangered and (or) threatened species or result in the destruction or modification of their critical habitat.

Wildlife

There would be nonquantifiable losses to wildlife populations which would not be caused directly by surface mine disturbance. Increases in human population would result in increased habitat deterioration from off-road vehicle use, increased legal and illegal harvest of wildlife, and mischievous shooting of raptors, prairie dogs, and other conspicuous wildlife.

Birds

Nongame. The primary songbird species impacted would be the horned lark, rock wren, black-billed magpie, sage thrasher, western meadowlark, Brewer's blackbird, vesper sparrow, sage sparrow, and Brewer's sparrow.

The proposed actions would account for the loss of an estimated 8,300, 59,500, and 112,400 birds by 1980, 1985, and 1990, respectively. These estimates include losses to the birds' progeny (offspring) which would have been produced had the disturbance not taken place. Based upon Wyoming Game and Fish breeding bird surveys, there is an average of 32 birds per square mile in the region. Using the formula for biotic potential, activities other than the proposed actions would account for the loss of an estimated 45,000, 230,000, and 340,000 birds and their progeny by 1980, 1985, and 1990, respectively. These figures represent less than 0.4% of the estimated small bird productivity in the region.

The proposed actions would physically eliminate 5 raptor nests. An additional 29 nests probably would not be used due to their proximity to mining activities. Included in the 29 disturbed nests would be 12 golden eagle nests. These 34 nests would have the potential to produce an estimated 100 offspring in a given year (using average clutch sizes). The number of birds that would have been produced had mining not taken place would be estimated at 1,200 by 1990. The proposed mines where nests would be eliminated would continue about 12 to 15 years beyond 1990, bringing total losses to an estimated 2,400 to 2,700 birds. The Bald Eagle Protection Act requires protection of the golden eagle and its nest. Consultation has begun with the Fish and Wildlife Service to protect twelve golden eagle nests. However, more definitive regulations and guidelines also are being sought to protect the eagle and the effects of habitat losses near the nests. Permit requirements of the Migratory Bird Act will prevent the losses to other raptors.

Game. The sage grouse is the only upland game bird in the region that would be significantly impacted. There would be a loss of 4,290, 10,106, and 14,764 acres of sage grouse yearlong range by 1980, 1985, and 1990, respectively. The 1990 figure represents about 0.2% of the total yearlong range available in the southwestern Wyoming region. In addition, there would be a loss of 1,325, 2,441, and 2,973 acres of crucial breeding range lost by 1980, 1985, and 1990, respectively. The 1990 figure represents about 0.5% of the total available crucial breeding range in the region. Using the sum total of sage grouse losses calculated for each proposed mine, regional losses would be estimated at 1,500, 4,800, and 8,200 birds and their progeny by 1980, 1985, and 1990, respectively. The 1990 figure would represent about 1.5% of the production of the total sage grouse population of the region by that time. Table R4-8D shows the acres of disturbance and the percentage that the disturbance would remove from the total range available in the region.

Activities other than the proposed actions would account for the loss of an estimated 550, 2,700, and 4,000 birds by 1980, 1985, and 1990.

Endangered and (or) Threatened. At this time and from currently available data, it is not anticipated that there would occur any adverse impact to any endangered and (or) threatened bird species. However, in accordance with Section 7 of the Endangered Species Act of 1973, the BLM has officially requested formal consultation with the U.S. Fish and Wildlife Service by letter dated 2 March 1978.

Under Section 7 of the Endangered Species Act of 1973, the Secretary of the Interior will grant no approval which would jeopardize the continued existence of any endangered and (or) threatened species or result in the destruction or modification of their critical habitat.

Specific species and area of concern for which consultation is presently being conducted is as follows: species—birds—American Peregrine Falcon; area of concern—proposed Black Butte Mine.

Mammals

Nongame. The primary small nongame mammal species affected would be whitetail prairie dog, Richardson ground squirrel, Uinta ground squirrel, least chipmunk, deer mouse, and sagebrush vole.

Using the sum of the losses for each site-specific proposed mine, total regional losses would be 1,232,000,

Table R4-8D

ACRES OF DISTURBANCE OF SEASONAL RANGES
AND THEIR RELATIONSHIP TO THE TOTAL RANGE AVAILABLE IN THE ES REGION (1990 ONLY)

Species	Year	Summer Range	% of Available Range	Yearlong Range	% of Available Range	Winter/ Yearlong Range	% of Available Range	Crucial Winter/ Yearlong Range	% of Available Range	Crucial Breeding Range	% of Available Range
Pronghorn antelope	1980	2,790				1,007					
	1985	5,497				2,192					
	1990	7,490	0.3%			4,256	0.3%				
Mule deer	1980	1,053				2,744		493			
	1985	2,976				6,636		493			
	1990	3,578	0.2%			10,693	0.7%	493	<0.1%		
Elk	1980	493 (1480)[1]						(740)[1]			
	1985	493 (1480)[1]						(740)[1]			
	1990	493 (1480)[1]	0.2%					(740)[1]	1.0%		
Moose	1980	410						216			
	1985	1,371						216			
	1990	1,646	0.3%					216	0.2%		
Sage grouse	1980			4,290						1,325	
	1985			10,106						2,441	
	1990			14,764	0.2%					2,973	0.5%

Note: The percent figures represent the amount of range the disturbance would remove by 1990 from the total range now available. In some cases, it was more practical to calculate percentages based on herd or management units rather than on a regional basis. These figures are underlined.

[1]Figures in parenthesis indicate indirect disturbance or "area of influence." (Percentages were based on the figures.)

7,731,000, and 13,470,000 by 1980, 1985, and 1990, respectively.

Using the formula for biotic potential, activities other than the proposed actions would account for the loss of 2.23 million, 11.5 million, and over 16 million animals, including their progeny, by 1980, 1985, and 1990, respectively. Although these figures seem large, they are only a minute percentage of the total production of small mammal populations within the region. In addition, it is realized that small mammal populations do fluctuate greatly and that losses would vary accordingly. However, habitat disturbance would remove the areas ability to produce that peak population until reclamation is successful.

Game. The big game species impacted would be pronghorn antelope, mule deer, elk, and moose (see Table R4-8D).

The proposed actions would eliminate about 2,790, 5,490, and 7,490 acres of antelope summer range and 1,007, 2,192, and 4,256 acres of antelope winter/ yearlong range by 1980, 1985, and 1990, respectively. The 1990 loss figures represent about 0.3% of the total summer range available and 0.3% of the total winter/ yearlong range available in the region.

Population losses would be estimated at 165, 685, and 1,370 antelope by 1980, 1985, and 1990, respectively. These figures include the progeny (offspring) that would have been produced had mining not taken place, assuming that 30% of the herd dies each year and is replaced by the same number of fawns. The 1990 figure of 1,370 would represent about 1% of the total antelope production in the region by that time. Losses from activities other than the proposed actions would account for the loss of an estimated 300, 900, and 1,400 antelope and their progeny by 1980, 1985, and 1990, respectively.

The proposed actions would eliminate about 1,053, 2,976, and 3,578 acres of mule deer summer range and about 2,744, 6,636, and 10,693 acres of mule deer winter/ yearlong range by 1980, 1985, and 1990, respectively. In addition, 493 acres of mule deer crucial winter/yearlong range would be eliminated by 1980 with no further disturbance by 1990. The 1990 figures for summer range, winter/ yearlong range, and crucial winter/yearlong range represent about 0.2%, 0.7%, and less than 0.1%, respectively, of the total of each range available in the region.

Assuming deer have the same productivity as antelope (30% per year), the proposed actions would account for the loss of an estimated 200, 540, and 850 deer and their progeny by 1980, 1985, and 1990, respectively. The 1990 figure of 850 would represent about 1% of the total deer production in the region by that time. Activities other than the proposed actions would account for an estimated loss of 250, 800, and 1,300 deer and their progeny by 1980, 1985, and 1990, respectively.

Elk losses resulting directly from surface disturbance would be expected on only one proposed mining area. Although the actual disturbance would be 493 acres of summer range, the area of influence would include 1,480 acres of summer range and 740 acres of crucial winter/ yearlong range. These areas would be expected to be totally lost to elk, since they are known to be sensitive to human activity (Ward 1973). The figure of 1,480 represents about 0.2% of the total summer range available in the region to the elk herd that occupies the vicinity of the proposed mine. The 740 acres represents about 1% of the crucial winter/yearlong range available in the region. It is estimated that 40 elk would be lost by 1980. The number of elk and their progeny that would be lost is estimated at 65, 100, and 160 animals by 1980, 1985, and 1990, respectively. The 1990 figure of 160 would represent about 5% of the production of the local herd by that time and about 0.7% of the production of the total regional elk population. Mining in this area, however, would continue through 2012 plus 6½ years for reclamation, bringing the total loss to an estimated 500 animals.

Moose losses also would be expected on only one area. There would be a loss of 216 acres of moose crucial winter/yearlong range by 1980 and a loss of 410, 1,371, and 1,646 acres of moose summer range by 1980, 1985, and 1990, respectively. The 216 acres lost represent about 0.2% of the crucial winter/ yearlong range available in the region to the local moose herd. The 1,646-acre loss of summer range by 1990 represents about 0.3% of the total summer range available in the region to the local moose herd. The total loss of moose and their progeny through 1990 is estimated at 20 animals. The loss of 20 animals by 1990 would represent about 0.5% of the production of the local moose herd by that time and about 0.1% of the production of the total regional population.

Endangered and (or) Threatened. At this time and from currently available data, it is not anticipated that there would occur any adverse impact to any endangered and (or) threatened mammal species. However, in accordance with Section 7 of the Endangered Species Act of 1973, BLM has officially requested formal consultation with the U.S. Fish and Wildlife Service by letter dated 2 March 1978. Specific species and area of concern for which consultation is presently being conducted are as follows: species—mammals—black-footed ferret; area of concern—proposed Black Butte, Long Canyon, and South Haystack Mines.

Under Section 7 of the Endangered Species Act of 1973, the Secretary of the Interior will grant no approval which would jeopardize the continued existence of any endangered and (or) threatened species or result in the destruction or modification of their critical habitat.

The U.S. Fish and Wildlife Service, Denver Research Center, under contract to the BLM, Wyoming State Office, began an intensive black-footed ferret survey in the general area of the proposed Black Butte Mine in June 1978 and in the vicinity of the proposed South Haystack Mine in July 1978. The results of these surveys are anticipated in October 1978.

Reptiles and Amphibians

General. The primary reptile and amphibian species impacted will be northern sagebrush lizard, desert shorthorned lizard, northern plateau lizard, northern sideblotched lizard, northern cliff lizard, prairie rattlesnake, tiger salamander, and Rocky Mountain toad.

There are an average of 2.5 individuals per acre in sagebrush and saltbush/ greasewood types and an average of 7 individuals per acre in the other major habitat types in the region. The proposed action would account for the loss of an estimated 17,000, 65,000, and 100,000 individuals and their progeny in the sagebrush and saltbush/ greasewood types by 1980, 1985, and 1990, respectively. In the other habitat types, loss would be 8,000, 20,000, and 23,000 by 1980, 1985, and 1990, respectively. The combined total would be estimated at 25,000, 90,000, and 125,000 individuals and their progeny by 1980, 1985, and 1990, respectively.

Activities other than the proposed actions would account for the loss of an estimated 37,000, 184,000, and 271,000 individuals and their progeny by 1980, 1985, and 1990, respectively.

Endangered and (or) Threatened. No adverse impact is anticipated to any endangered and (or) threatened reptile or amphibian species.

Wild Horses

No impacts to wild horses would be expected, since the proposed mines are located where BLM management plans call for total removal of wild horses.

CULTURAL RESOURCES

Impacts to cultural resources would include (1) destruction or alteration of all or part of a property; (2) isolation from or alteration of its surrounding environment; and (3) introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting (36 CFR 800.9). These impacts may take place to both archeological and historical sites in the region.

The loss of cultural resource sites and the data contained therein would be a direct result of their physical destruction through land modification required in mining and associated surface facilities, access roads, rail spurs, power lines, as well as subsidence resulting from underground mining. Site destruction would also occur through development related events such as increased population which could lead to increased pothunting and vandalism and increased vehicular use of the land resulting in some unintentional destruction of cultural resources.

Because cultural resources are nonrenewable, the physical destruction of any cultural data or artifacts could eventually have a potentially significant impact on efforts to reconstruct the prehistory and history of the region. The beneficial impacts to cultural resources from proposed coal development has been the accumulation of knowledge about the history and prehistory of the region as a result of required inventories which have been conducted.

Archeological

Table R4-9A estimates the number of archeological sites that are threatened with destruction from mining and other surface disturbance through 1990. These estimates are based upon the 59% of the five mine site areas that have been surveyed. Potential archeological site destruction from surface disturbance by activities other than the proposed actions are also estimated in Table R4-9A.

The potential for unknown buried archeological sites exists within each project area and associated rights-of-way. Unknown Early period and Altithermal sites would most likely have been covered with Quaternary deposits through time and, because of their scarcity, would be significant in the region if they exist. These sites are not and would not be evident before actual surface disturbance uncovered them. Any surface disturbing activity could partially or completely destroy them, and the site pass unnoticed.

The increase in pothunting, arrowhead collecting, and vandalism that would result from an increase in population would affect all known and unknown resources within the region. The significance of this impact is potentially great, since the kind of data removed by these activities, arrowheads and tools, are the major resources for dating and analyzing prehistoric activity.

Total cumulative regional surface disturbances would result in potential impacts to 79 sites by 1980, 195 sites by 1985, and 301 sites by 1990. Since the signficance of an impact is dependent upon the archeological information lost by destruction of the archeological resource, and this is unknown, it is impossible to evaluate the significance of these impacts until the location and nature of these disturbances have been identified.

Historical

Significant historical sites in the region are better known and recorded than prehistoric sites.

The Black Butte Stage Station, Gibraltar Mine site, and Hallville are eligible for nomination to the National Register of Historic Places. Proposed coal mining boundaries encompass the site of the stage station and old mine sites. Possible adverse effects include inadvertent destruction of the station or mine sites, since they are within one-quarter mile of proposed construction and mining activities. Definite adverse effects would include the introduction of visual, audible, and atmospheric elements to the surroundings and the alteration of the surrounding environment. The townsite of Cumberland lies within the proposed rights-of-way for the South Haystack rail spur and would possibly receive impacts from construction activities.

Increased population with related increases in vandalism and bottle hunting could potentially impact these and other known historical sites in the region. Direct physical and visual impacts to known historical sites would occur to a total of four sites near specific proposed coal mining areas.

Table R4-9A

ARCHEOLOGICAL SITES THREATENED BY DISTRIBUTION

	Present-1980	1980-1985	1985-1990	Cumulative Total
Inventoried sites	23	26	42	91
Estimated number of sites potentially impacted by other surface disturbances	56	90	64	210
Total	79	116	106	301

Mine and recreationally-related vehicular use could result in the unintentional destruction of Overland Trail segments in the region. Because all of the historic sites and related trail segments which would be impacted directly or indirectly are unique and irreplaceable, their loss could in no way be alleviated.

VISUAL RESOURCES

Prior to coal mining, visual resource contrast ratings would be conducted for each area based on a specific mining plan to evaluate which visual elements would be affected by the proposed management activity. This evaluation would show which activities need to be modified in order to meet the Visual Resource Management (VRM) class objectives for that area. The criteria by which the contrast ratings would be conducted are included in BLM Manual 6320.

The greatest visual impacts would be experienced where the region's federal, state, and county roads provide visual access to the mining areas. Map 10 in Appendix A depicts the proposed mining areas in reference to VRM classes. Activities and developments which would adversely affect the visual quality would be the placement of access roads, railroads, power lines, pipelines, and structures on the landscape. Even more critical would be the strip mining and other mining developments and surface disturbances which would adversely affect the visual resources.

As the access roads, railroads, power lines, pipelines, and other structures are constructed, they would place intrusions on the landscape which contrast with the basic elements of form, line, color, and texture. This would result in a change of VRM class from a Class II, III, or IV to a temporary Class V. After mining and reclamation, the developments would be removed and areas disturbed seeded. This would reduce the impacts so that only the elements of color and texture in the vegetation feature would have contrasts. After the areas are successfully revegetated with plant species similar to the surrounding environment, the impacts would disappear altogether. The area would then return to the same VRM class as the surrounding countryside.

The strip mining and other mining development and surface disturbances would completely eliminate the characteristic landscape on the mined areas. There would be strong contrasts on all the basic landscape elements (form, line, color, and texture). This would result in a change of VRM class from a Class II, III, or IV to a Class V. After the mined areas are rehabilitated, the areas would not be returned immediately to the condition which existed prior to the mining as there would be changes in topography and a general lowering of the altitude of the land. The plant species that would be planted would be mostly grasses which would create moderate to strong contrasts on the elements of line, color, and texture. The result would be a temporary change of the visual class which existed prior to mining if that class was Class II or III. The highest VRM class that could be achieved immediately after reclamation would be a Class IV. It is expected that the mined areas would be returned to their premined VRM class several years after reclamation due to natural succession of native plant species; however, this would depend upon the specific reclamation of each mine site. Wherever the VRM class is changed, whether temporary or permanent, the area would not meet management's objective to maintain the visual quality of the region. Short-term changes are allowed in the system; however, long-term changes are considered significant impacts.

RECREATION RESOURCES

The impacts of the proposed actions would affect recreation to some degree by the direct removal of approximately 50,000 acres from the land base for recreational use. However, there would be a greater impact to recreation by an increased number of persons recreating in the region.

The increased number of people traveling to the country for recreation would have two basic impacts. First, there would be conflicts between the recreationists and landowners due to increased numbers of people crossing private lands. This would prompt the landowners to restrict access to and across their land. Second, the typical type of recreation in southwestern Wyoming involves people traveling to the country to find solitude and other amenities. The increased number of people going to the country would greatly reduce the quality of this primitive recreation for the entire region. There would be an increased number of people leaving the region to find suitable recreation.

The increases in recreational use would not only be on public lands but also on private lands and in the local towns. The Forest Service lands in and adjacent to the region would receive a major portion of the increased use.

Visitor Use Data

Table R4-11A shows estimated visitor use demand due to the proposed actions and overall regional changes, and Map 11 in Appendix A shows distribution of these activities. The numbers illustrate the change in recreation use due to population increases in the region. The data used to calculate numbers are available for public review in the Rock Springs District Office of the BLM.

Resources

Fishing

Due to increased population in the region, an increased number of people trying to find a quality fishing place would also reduce the primitive nature of the fishing experience.

Table R4-11A

ESTIMATED RESIDENT VISITOR DAYS DEMAND DUE TO POPULATION CHANGE FOR YEARS 1980, 1985, AND 1990

Activity	1977	1980 Population: 3,760[1] Without Proposed Action	Increase Due to Proposed Action	Total Projection	% of Projection Due to Proposed Action	1985 Population: 7,135[1] Without Proposed Action	Increase Due to Proposed Action	Total Projection	% of Projection Due to Proposed Action	1990 Population: 7,199[1] Without Proposed Action	Increase Due to Proposed Action	Total Projection	% of Projection Due to Proposed Action
Fishing	250,300	278,500	16,000	294,500	5.4	313,100	30,900	344,000	9.0	335,500	31,500	367,000	8.6
General[2]	224,700	273,000	15,700	288,700	5.4	312,700	30,900	343,600	9.0	339,300	31,900	391,200	8.6
Hunting	79,100	85,900	4,900	90,800	5.4	94,300	9,300	103,600	9.0	99,400	9,300	108,700	8.6
Off-road vehicles[3]	9,800	10,700	600	11,300	5.3	11,800	1,200	13,000	9.2	12,500	1,200	13,700	8.7
Sightseeing	76,800	84,200	4,800	89,000	5.4	95,400	9,400	104,800	9.0	102,600	9,600	112,200	8.6
Urban	154,500	178,100	10,200	188,300	5.4	215,100	21,200	236,300	9.0	239,300	22,500	261,800	8.6
Water sports	115,500	130,900	7,500	138,400	5.4	153,600	15,200	168,800	9.0	168,800	15,900	184,700	8.6
Winter sports	31,200	36,600	2,100	38,700	5.4	46,200	4,600	50,800	9.1	52,000	4,900	56,900	8.6

[1]Population change due to proposed action (from Socioeconomic Conditions section).
[2]General includes camping, picknicking, etc.
[3]Estimate by ES team Outdoor Recreation Planner.

Hunting

Concentrated human activity as well as surface disturbance tends to displace wildlife. As these animals move from an area, there is a loss of huntable land base. The increased density of hunters would result in a decrease in quality of the hunting experience. More hunters would travel to areas outside the region to hunt.

Sightseeing

Mining would offer opportunities for geologic and industrial interpretation and would tend to draw people to the area to view the mining activities. The additional population would also increase the number of people traveling to the area. However, the areas of mining activity would be restricted from normal visitor use.

Specialized Activities

Off-Road Vehicles

Areas of mining activity usually have restricted access; this would reduce the land base which the recreationists are able to use by approximately 50,000 acres. Some of the roads through the areas would be improved during the mining operations and would offer better quality experiences to the off-road user by providing better access to the off-road vehicle areas after conclusion of mining and reclamation.

As people move into the ES region, there would be more off-road vehicle activity.

Existing Recreational Developments

There would be no destruction of any recreational developments due to mining activity. However, increased populations using the existing developments in the region would create a need for additional moneys for collecting garbage, rebuilding vandalized sites, and constructing new recreation sites as existing facilities become overloaded. There would be some minor impacts to Flaming Gorge National Recreation Area and Fossil Buttes National Monument as air quality is affected by increased suspended particulates.

AGRICULTURE

Livestock Grazing

The proposed actions would cause an estimated 652, 4,460, and 9,333 animal unit months (AUMs) to be lost by 1980, 1985, and 1990, respectively. The AUMs lost would represent but a small fraction of the total AUMs available in the region. Public rangelands (56% of the region) provide about 357,000 AUMs per year (Pioneer Trails and Salt Wells/Pilot Butte Management Framework Plans of the BLM 1977), and deeded and state rangelands produce an estimated 304,000 AUMs annually, assuming range sites and condition classes are similar to public rangelands. The loss of AUMs would be of little consequence to the region's livestock industry.

The loss of AUMs from both the proposed actions and other activities would be detrimental to the region's livestock industry but would not significantly affect production of livestock. Reclamation would be conducted on an estimated 45% (28,511 acres) of the acreage which would be disturbed by 1990 (65,152 acres or 1% of the region's surface acreage).

Federal grazing licenses would be reduced by the appropriate number of AUMs lost on public lands as the result of mining. Restoration of grazing privileges would be made upon reclamation, as it is believed that reclaimed lands would be capable of supporting premining livestock stocking rates. The reclaimed lands, however, would require more intensive grazing management than would be needed for undisturbed rangeland (Lang, Berg, Hodder (Vories ed. 1976)).

Additional people in the region would probably result in increased incidents of range improvement vandalism and livestock theft, butchering, and molestation.

Water needed for mining and other activities could, in some cases, adversely affect water supplies for livestock. Surplus water on deeded lands, however, could be sold by some livestock operators for extra income.

New and (or) improved road networks and utility lines could benefit some livestock operators.

The competition for labor due to higher paying industrial jobs and inflationary rises in the costs of goods and commodities associated with a "boom"in population would be other detrimental impacts to the region's livestock industry (see Socioeconomic Conditions section).

Prime Farmland

Consultation with personnel of the U.S. Department of Agriculture, Soil Conservation Service, Rock Springs, Wyoming, revealed that prime farmland would not be affected by the proposed actions (see Chapter 9, Consultation and Coordination). Data are lacking to determine if activities other than the proposed actions would affect such lands.

MINERAL RESOURCES

Annual production of coal would be 24 million tons by 1980 and 31.2 million tons by 1985 and after. A cumulative total of approximately 352.9 million tons would be mined from 1977 through 1990 which is 0.25% of the Wyoming coal reserves under less than 3,000 feet of overburden.

The following is the projected annual production from 1977 to 1990 in millions of tons: 1977—10.5, 1978—11.0, 1979—16.5, 1980—24.0, 1981—24.0, 1982—25.4, 1983—

26.9, 1984—27.4, 1985—31.2, 1986—31.2, 1987—31.2, 1988—31.2, 1989—31.2, and 1990—31.2.

Approximately 84 million tons of coal would not be recovered due to losses inherent in the mining methods used to produce the coal. About 50% recovery of economically minable coal is experienced with the underground mining and about 90% recovery is obtained with surface mining methods. An unknown quantity of coal in the overburden and (or) interburden would be lost. This coal would be in seams too thin or of too low a quality to be of economic interest.

Coal development would not significantly impact the production of other mineral resources.

TRANSPORTATION NETWORKS

Impacts on transportation networks would be caused by: (1) mining of coal and construction of utilities and transportation facilities, (2) transportation of coal out of the region, and (3) increased employment and population with its attendant increase in vehicles and miles traveled.

The actual impacts to transportation networks would result from population increases. Table R4-14A depicts the estimated increased number of vehicle tab sales in the region based on increased populations. The impact would be primarily from employees commuting on highways and increased air traffic at the Rock Springs Airport. The increased use may not change the per capita traffic accident rate, but there would be an increase in the number of accidents due to the increased numbers of miles traveled.

Increased highway use would lead to the need for more maintenance as the heavy use breaks down the roadbed. With the increased use there is the probability of increased litter problems and fire hazards.

There would be a need to relocate certain roads and trails affected directly by coal mining. Table R1-1 depicts the number of roads and miles which would be affected. This could lead to other roads being used more heavily. Local ranchers would possibly become irritated with increased traffic across their private lands and would then tend to limit access across their lands.

Transportation would be impacted by the construction of 38.8 miles of railroad spurs which would cross several unimproved and graded dirt roads, many lesser roads which are generally lightly used for access to oil fields, and one highway. Grade crossings or detours would be provided during construction which would cause an inconvenience impact on travelers. There would be minor traffic tie-up problems at the railroad grade crossings and a potential increase of train-auto accidents.

There would be the need to relocate 10 miles of power transmission lines and 3.2 miles of pipelines due to mining activity.

The impacts from the transportation of coal, its derivatives, and service supplies would be expected to be confined to highways and railroads. The transportation of electricity and natural gas would not impact other systems. The shipment of service supplies by highway would increase traffic volume. The accelerated traffic would increase road wear and the roads would require more maintenance. Table R4-14B and Map 13A, Appendix A, depict the estimated changes in rail traffic due to coal shipment by train. Tables R4-14C and R4-14D depict the approximate projected increases in related train emissions and changes in noise corridors along the Union Pacific Railroad.

Rail traffic volume without coal will increase an estimated average of 3% per year. By 1990, the estimated traffic volumes will range from 40% to 97.5% of estimated capacity. With the addition of coal traffic to these lines, the traffic volumes would range from 41% to 101% of estimated capacity depending on the segment of rail line (see Table R4-14B). The most critical segment of track, from Gibbon to North Platte, would be where the traffic volume would exceed the estimated capacity. This segment of track would have to be upgraded to increase capacity.

SOCIOECONOMIC CONDITIONS

Socioeconomic impacts (cumulative and of the proposed actions) were determined in the following manner. The effects of all anticipated new activities in the region, other than the proposed actions, as presented in Chapter 1 (oil, gas, trona mines, Naughton Power Plant, etc.) were first projected. These same effects were then projected with the proposed actions included. The total growth shown in this projection reveals cumulative impacts. The difference between the two projections is the impact of the proposed actions. A complete description of the model used to project the population is available for review at the Rock Springs District Office of the BLM.

Approval of the proposed actions, with associated increases in employment and population, would have varying impacts (positive and negative) on the socioeconomic conditions of the ES region. In fact, the increase in population that would occur is the foundation and cause of many of the secondary impacts discussed in this section.

Population

If the proposed actions, as described in Chapter 1, are approved, the resulting direct and induced employment would cause the population of the southwestern Wyoming ES region to increase. This increase would be over and above that projected for normal growth and all other anticipated new activities as described in Chapter 1. Considering the cumulative effect of these factors, the population of the region is projected to increase from an estimated 59,916 in 1977 to 69,261 in 1980, 79,420 in 1985, and 83,853 in 1990 (Table R4-15A and Figure R4-15A). The proposed actions would be directly responsible for increases in the population of 3,761 by 1980, 7,135 by 1985, and 7,199 by 1990. They would also cause the annual rates of growth of all counties and communities to increase (Table R4-15B). The most significant increases would occur between 1977 and 1980, when the

Table R4-14A

ESTIMATED VEHICLE LICENSE TAB SALES

	1976	1978-1980	1980-1985	1985-1990
Sales without proposed actions	52,500	59,600	65,800	69,700
Sales due to proposed actions	N/A	3,400	6,500	6,600
Sales total regional cumulative	N/A	63,000	72,300	76,300

N/A = Not Applicable

Table R4-14B

ESTIMATED TRAIN VOLUME INCREASES ON TRACK SEGMENTS OF THE UNION PACIFIC RAILROAD IN AVERAGE TRAINS PER DAY

Segment	Estimated[1] Capacity	Current[1,2] Traffic	1980 Projected[3,4] Volume w/o Coal	1980 Total[1] Number Coal Training	1980 Coal Trains[4] due to P.A.	1980 Total Volume	1985 Projected[3,4] Volume w/o Coal	1985 Total[1] Number Coal Training	1985 Coal Trains[4] due to P.A.	1985 Total Volume	1990 Projected[3,4] Volume w/o Coal	1990 Total[1] Number Coal Training	1990 Coal Trains[4] due to P.A.	1990 Total Volume
Kansas City to Topeka	70-80	44	48	2.6	0.5	48.5	56	1.8	0.5	56.5	65	1.6	0.5	65.5
Topeka to Gibben	70-80	22	24	5.0	0.5	24.5	28	7.6	0.5	28.5	32	7.0	0.5	32.5
Council Bluffs to Gibbon	55-60	34	37	10.8	1.9	38.9	43	11.0	2.3	45.3	50	10.2	2.3	52.3
Gibbon to North Platte	70-80	53	58	16.0	2.4	60.4	67	18.4	2.8	69.8	78	17.6	2.8	80.8
North Platte to Cheyenne	70-80	47	51	12.8	2.4	53.4	60	12.2	2.8	62.8	69	11.4	2.8	71.8
Cheyenne to Hanna	70-80	51	56	13.4	2.4	58.4	65	12.8	2.8	67.8	75	11.4	2.8	77.8
Hanna to Rawlins	70-80	45	49	6.2	2.4	51.4	57	5.2	2.8	59.8	66	5.8	2.8	68.8
Rawlins to Rock Springs	70-80	44	48	6.2	2.4	50.4	56	6.2	2.8	58.8	65	6.8	2.8	67.8
Rock Springs to Green River	70-80	44	48	1.4	2.2	50.2	56	2.6	2.6	58.6	65	3.4	2.6	67.6
Green River to Granger	70-80	40	44	1.8	2.2	46.2	51	3.0	2.6	53.6	59	3.8	2.6	61.6
Granger to Kemmerer	25-30	13	14	2.6	2.2	16.2	16	4.6	2.6	18.6	19	6.8	2.6	21.6
Kemmerer to McCammon	25-30	13	14	1.4	3.3	17.3	16	2.8	4.5	20.5	19	4.0	4.5	23.5
McCammon to Pocatello	25-30	15	16	2.8	3.3	19.3	19	5.8	4.5	23.5	22	9.4	4.5	26.5

[1] Union Pacific Railroad Company 1978.
[2] Through freight only.
[3] Abt Associates 1978.
[4] Estimates by ES team.

Table R4-14C

PROPOSED ACTION ALTERNATIVE--ESTIMATED TOTAL EMISSIONS: SOUTHWESTERN WYOMING ES REGION
Relative Impacts

Routes	1977 Existing Conditions	1980			1985			1990		
		Relative Projection	Cumulative Impact	Impact of Proposed Actions	Relative Projection	Cumulative Impact	Impact of Proposed Actions	Relative Projection	Cumulative Impact	Impact of Proposed Actions
Kemmerer-Idaho border	1.00	1.20	0.20	0.15	1.25	0.25	0.15	1.45	0.45	0.15
Granger-Kemmerer	1.00	1.14	0.14	0.14	1.21	0.21	0.14	1.29	0.29	0.15
Granger-Utah border	1.00	1.06	0.06	0.02	1.10	0.10	0.02	1.16	0.16	0.02
Granger-Green River	1.00	1.08	0.08	0.05	1.13	0.13	0.05	1.19	0.19	0.05
Green River-Eastern border of ES region	1.00	1.07	0.07	0.04	1.13	0.13	0.05	1.18	0.18	0.05
Rock Springs-north	1.00	1.00	0.00	0.00	2.00	1.00	0.50	2.00	1.00	0.50
Kemmerer-south	1.00	1.17	0.17	0.17	1.33	0.33	0.33	1.33	0.33	0.33

Source: Abt Associates 1978.

Note: Relative impacts must be analyzed since absolute current air quality levels are not known. Also, using a common standard (e.g., lb./mile) is the most appropriate measure for comparing impacts on rail segments with different lengths and differing current levels of existing traffic.

Table R4-14D

PROPOSED ACTIONS--NOISE CORRIDORS AND APPROXIMATE ACRES OF AFFECTED PROPERTY WITHIN MAJOR COMMUNITIES: SOUTHWESTERN WYOMING ES REGION

Communities	1977 Feet/ Acres	Projection	1980 Cumulative Impact	Impact of Proposed Actions	Projection	1985 Cumulative Impact	Impact of Proposed Actions	Projection	1990 Cumulative Impact	Impact of Proposed Actions
Rock Springs										
North Spur										
Width of noise corridor	876 ft.	876 ft.	0	0	1,180 ft.	340 ft.	80 ft.	1,180 ft.	304 ft.	80 ft.
Total acres involved	340 ac.	340 ac.	0	0	458 ac.	118 ac.	31 ac.	458 ac.	118 ac.	31 ac.
Main line										
Width of noise corridor	4,056 ft.	4,160 ft.	104 ft.	64 ft.	4,268 ft.	212 ft.	66 ft.	4,276 ft.	220 ft.	40 ft.
Total acres involved	3,445 ac.	3,533 ac.	88 ac.	54 ac.	3,625 ac.	180 ac.	58 ac.	3,632 ac.	187 ac.	34 ac.
Green River										
Width of noise corridor	4,128 ft.	4,212 ft.	84 ft.	12 ft.	4,276 ft.	148 ft.	24 ft.	4,296 ft.	168 ft.	4 ft.
Total acres involved	910 ac.	928 ac.	18 ac.	2 ac.	942 ac.	32 ac.	2 ac.	947 ac.	37 ac.	1 ac.
Kemmerer										
Width of noise corridor	2,876 ft.	3,138 ft.	262 ft.	212 ft.	3,262 ft.	386 ft.	300 ft.	3,420 ft.	544 ft.	282 ft.
Total acres involved	1,080 ac.	1,180 ac.	100 ac.	81 ac.	1,225 ac.	145 ac.	113 ac.	1,285 ac.	205 ac.	106 ac.
Evanston										
Width of noise corridor	3,650 ft.	3,730 ft.	80 ft.	30 ft.	3,776 ft.	126 ft.	14 ft.	3,876 ft.	226 ft.	36 ft.
Total acres involved	1,130 ac.	1,157 ac.	27 ac.	9 ac.	1,172 ac.	42 ac.	5 ac.	1,203 ac.	70 ac.	11 ac.

Source: Abt Associates 1978.

Table R4-15A

PROJECTED POPULATION: SOUTHWEST WYOMING ES REGION

	1977	1980				1985				1990			
		Population Projection				Population Projection				Population Projection			
	Estimated Population	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions
Sweetwater County	41,263	45,320	47,305	6,042	1,985	52,951	57,116	15,853	4,165	57,286	61,483	20,220	4,197
Rock Springs	25,996	28,552	29,909	3,913	1,357	33,359	36,132	10,136	2,773	36,090	38,889	12,893	2,799
Green River	12,502	13,732	14,185	1,683	453	16,044	17,133	4,631	1,089	17,358	18,449	5,947	1,091
Balance of county	2,765	3,036	3,211	446	175	3,548	3,851	1,086	303	3,838	4,145	1,380	307
Lincoln County	7,132	7,799	8,675	1,543	876	7,120	8,176	1,044	1,056	7,233	8,314	1,182	1,081
Kemmerer/ Diamondville	3,655	3,996	4,790	1,135	794	3,648	4,605	950	957	3,706	4,685	1,030	979
Balance of county	3,477	3,803	3,885	408	82	3,472	3,571	94	99	3,527	3,629	152	102
Uinta County	11,521	12,381	13,281	1,760	900	12,214	14,128	2,607	1,914	12,135	14,056	2,535	1,921
Evanston	5,918	6,360	6,995	1,077	635	6,274	7,625	1,707	1,351	6,234	7,590	1,672	1,356
Lyman	2,392	2,571	2,729	337	158	2,536	2,873	481	337	2,520	2,858	466	338
Mountain View	677	728	768	91	40	718	802	125	84	713	798	121	85
Balance of county	2,534	2,722	2,789	225	67	2,686	2,828	294	142	2,668	2,810	276	142
Regional totals	59,916	65,500	69,261	9,345	3,761	72,285	79,420	19,504	7,135	76,654	83,853	23,937	7,199

Source: Abt Associates 1978.

Note: Cumulative impact = projection "with" the proposed actions - 1977 estimate.
Impact of the proposed actions = projection "with" the proposed actions - projection "without" the proposed actions.

Table R4-15B

PROJECTED AVERAGE ANNUAL POPULATION RATES OF GROWTH: SOUTHWESTERN WYOMING ES REGION

	1978 - 1980			1981 - 1985			1986 - 1990		
	Growth Rate Projection (%)			Growth Rate Projection (%)			Growth Rate Projection (%)		
	Without Proposed Actions	With Proposed Actions	Impact of Proposed Actions (%)	Without Proposed Actions	With Proposed Actions	Impact of Proposed Actions (%)	Without Proposed Actions	With Proposed Actions	Impact of Proposed Actions (%)
Sweetwater County	3.3	4.9	1.6	3.4	4.1	0.7	1.6	1.5	-0.1
Rock Springs	3.3	5.0	1.7	3.4	4.2	0.8	1.6	1.5	-0.1
Green River	3.3	4.5	1.2	3.4	4.2	0.8	1.6	1.5	-0.1
Balance of county	3.3	5.4	2.1	3.4	4.0	0.6	1.6	1.5	-0.1
Lincoln County	3.1	7.2	4.1	-1.7	-1.2	0.5	0.3	0.3	0
Kemmerer/ Diamondville	3.1	10.4	7.3	-1.7	-0.8	0.9	0.3	0.3	0
Balance of county	3.1	3.9	0.8	-1.7	-1.6	0.1	0.3	0.3	0
Uinta County	2.5	5.1	2.6	-0.3	1.3	1.6	-0.1	-0.1	0
Evanston	2.5	6.1	3.6	-0.3	1.8	2.1	-0.1	-0.1	0
Lyman	2.5	4.7	2.2	-0.3	1.1	1.4	-0.1	-0.1	0
Mountain View	2.5	4.5	2.0	-0.3	0.9	1.2	-0.1	-0.1	0
Balance of county	2.5	3.4	0.9	-0.3	0.3	0.6	-0.1	-0.1	0
Regional totals	3.1	5.2	2.1	2.1	2.9	0.8	1.2	1.1	-0.1

Source: Abt Associates 1978.

Note: Impact of proposed actions = projection "with" the proposed actions - projection "without" the proposed actions.

proposed actions would raise the regional annual growth rate by 2.1%. 1980 would be the peak of the construction period; at this time, there would be 580 construction employees (maximum projected) working at the 5 proposed mines (see Table R1-2). The largest cumulative impacts would be in Lincoln County (7.2%), Kemmerer/Diamondville (10.4%), and Evanston (6.1%); no community would have a rate lower than 4.5% during the 1977 to 1980 period. Such rates are generally considered in excess of that which the typical small town as found in the region can efficiently absorb (Gilmore and Duff 1975). It is usually beyond their ability to provide essential services (housing, medical services, etc.) at a rate beyond 2% or 3% growth per year. Therefore, if the expected increases occur, they would represent impacts of high significance during the initial growth period. Once the growth subsided and communities had a chance to respond to it, the impacts would be reduced in significance to a low or medium condition.

Sweetwater County would receive approximately 85% of the region's cumulative growth between 1977 and 1990. Its share of the region's population distribution by county would increase from 68.9% in 1977 to 73.3% in 1990 (see Figure R4-15A). Rock Springs would receive nearly 67% (2,799 persons) of this growth by 1990 and Green River would receive approximately 26% (1,091 persons) of it.

Lincoln County and Kemmerer/Diamondville would have the largest annual rates of growth in the region during the 1977 to 1980 period, 7.2% and 10.4%, respectively. The county's total population would enter a period of decline during the 1980 to 1985 period; its growth rate would then stabilize near zero between 1985 and 1990 (see Table R4-15B). The impact of the proposed actions in Lincoln County would be an additional 876 persons by 1980, 1,056 by 1985, and 1,081 by 1990 (see Table R4-15A). Kemmerer/Diamondville would receive over 90% (979 persons) of this growth by 1990.

Uinta County's share of the region's population would decline from 19.2% in 1977 to 16.8% in 1990. It would have a relatively high annual growth rate (5.1%) between 1977 and 1980, but its rate would steadily decline thereafter (see Table R4-15B). The impact of the proposed actions in Uinta County would be an increase of 900 persons by 1980, 1,914 by 1985, and 1,921 by 1990. Evanston would receive approximately 71% (1,356 persons) of the total growth by 1990.

By 1990, the impact of the proposed actions on population growth in the ES region would be essentially zero; however, its population would be larger by 7,199 persons because of them. This is approximately 30% of the cumulative growth (23,937 persons) expected in the region. The growth impacts caused by the proposed actions would be significant during the 1977 to 1980 period but would steadily decline thereafter in Lincoln and Uinta Counties. The impacts would remain moderately significant in Sweetwater County until 1985. The characteristics of the ES region's population in 1990 would show that Sweetwater County had gained a larger percentage of the total population, the male/female ratio would have nearly equalized, and there would be slightly less persons (as a percentage) in the younger age groups (Abt Associates 1978). The population impacts would have indirect impacts, both positive and negative, on the southwestern Wyoming ES region that are subsequently discussed in this section.

Employment

Employment projections are based upon anticipated economic developments in the region and planned employment as reported by the mining and other industries (see Chapter 1 for specific assumptions). Total employment within the ES region is projected to increase from an estimated 28,118 jobs in 1977 to 33,057 by 1980, 37,784 by 1985, and 39,810 by 1990 (Table R4-15C and Figure R4-15A). The proposed actions would be responsible for a significant portion of the new job opportunities: 45% (2,223 jobs) by 1980, 36% (3,489 jobs) by 1985, and 30% (3,497 jobs) by 1990. Over 58% (2,041) of the 3,497 new jobs made available by the proposed actions would be in Sweetwater County.

Mining as a percent of total employment would increase in all three counties. Regionwide, it would expand from an estimated 20% (5,645 mining jobs) of 1977 employment to 31% (12,178 mining jobs) in 1990. The peak construction period would occur in 1980 with 580 construction employees.

Unemployment rates would be lower through 1985 because of the proposed actions (Abt Associates 1978). After 1985, the impact would be negligible. Sweetwater County would be most significantly impacted with a 32% (47 persons) reduction in 1985.

There are several indirect impacts that would occur because of the increases in employment. The impact on population has already been discussed. Three others that are not quantifiable would also be expected to occur. First, laborers could be attracted to the mining industry from other sectors because of generally higher wages. This could cause temporary shortages in the other sectors. Second, if the mining industry could not find enough laborers in the region, it would have to attract them from outside. This may be difficult, but it would also increase the gap between the income of those drawing the high wages of the mining industry and those in the lower paying service sectors, as mining wages might have to be further increased. The third impact would be a reduction in productivity in the mining industry. This would be a result of the large turnover of personnel caused by the crowded conditions, lack of services, and an unrewarding life style frequently experienced in high growth areas (Gilmore and Duff 1975). These impacts would be of low significance when compared to the highly beneficial aspects of a large increase in job opportunities.

Income

Anticipated increases in industrial activity, employment, and population would also cause the income of the

Table R4-15C

PROJECTED EMPLOYMENT BY SECTOR: SOUTHWESTERN WYOMING ES REGION

	1977	1980				1985				1990			
		Employment Projection				Employment Projection				Employment Projection			
	Estimated Employment	Without Proposed Action	With Proposed Action	Cumulative Impact	Impact of Proposed Action	Without Proposed Action	With Proposed Action	Cumulative Impact	Impact of Proposed Action	Without Proposed Action	With Proposed Action	Cumulative Impact	Impact of Proposed Action
Sweetwater County	19,653	21,571	22,787	3,134	1,216	25,453	27,494	7,841	2,041	27,446	29,487	9,834	2,041
Proprietors	1,081	1,161	1,221	140	60	1,350	1,451	370	101	1,445	1,547	466	102
Farm	116	98	97	- 19	- 1	92	92	- 24	0	88	87	- 29	- 1
Nonfarm	965	1,063	1,124	159	61	1,258	1,359	394	101	1,357	1,460	495	103
Wage and Salary	18,572	20,410	21,566	2,994	1,156	24,103	26,043	7,471	1,940	26,001	27,940	9,368	1,939
Farm	243	211	211	- 32	0	209	209	- 34	0	208	207	- 36	1
Nonfarm	18,329	20,199	21,355	3,026	1,156	23,894	25,834	7,505	1,940	25,793	27,733	9,404	1,940
Government	1,821	2,333	2,405	584	72	2,626	2,772	951	146	2,763	2,907	1,086	144
Private	16,508	17,866	18,950	2,442	1,084	21,268	23,062	6,554	1,794	23,030	24,826	8,318	1,796
Manufacturing	358	510	524	166	14	612	671	313	59	677	738	380	61
Mining	4,897	6,911	7,256	2,359	345	8,291	9,017	4,120	726	9,002	9,726	4,829	724
Construction	4,736	1,430	1,737	-2,999	307	1,651	1,766	-2,970	115	1,764	1,880	-2,856	116
Transportation	1,167	1,504	1,495	328	- 9	1,670	1,770	603	100	1,800	1,904	737	104
Trade	2,930	4,190	4,385	1,455	195	5,076	5,557	2,627	481	5,565	6,051	3,121	486
Finance, Insurance and Real Estate	217	283	287	70	4	319	340	123	21	342	363	146	21
Services	2,169	2,985	3,207	1,038	222	3,580	3,865	1,696	285	3,805	4,082	1,913	277
Other	34	53	59	25	6	69	76	42	7	75	82	48	7
Lincoln County	3,670	4,110	4,712	1,042	602	3,731	4,333	663	602	3,797	4,405	735	608
Proprietors	800	782	783	- 17	1	758	773	- 27	15	750	761	- 39	11
Farm	269	246	246	- 23	0	234	234	- 35	0	222	221	- 48	- 1
Nonfarm	531	536	537	6	1	524	539	8	15	528	540	9	12
Wage and Salary	2,870	3,328	3,929	1,059	601	2,973	3,560	690	587	3,047	3,644	774	597
Farm	227	214	214	- 13	0	209	209	- 18	0	204	204	- 23	0
Nonfarm	2,643	3,114	3,715	1,072	601	2,764	3,351	708	587	2,843	3,440	797	597
Government	492	509	544	52	35	486	522	30	36	490	527	35	37
Private	2,151	2,605	3,171	1,020	566	2,278	2,829	678	551	2,353	2,913	762	560
Manufacturing	183	171	165	- 18	- 6	174	170	- 13	- 4	174	170	- 13	- 4
Mining	626	999	1,362	736	363	1,114	1,607	981	493	1,183	1,682	1,056	499
Construction	517	602	770	253	168	180	206	-311	26	182	209	-308	27
Transportation	210	207	211	1	4	205	208	- 2	3	205	209	- 1	4
Trade	351	354	372	21	18	346	359	8	13	347	361	10	14
Finance, Insurance and Real Estate	40	41	44	4	3	39	42	2	3	40	43	3	1
Services	207	214	229	22	15	204	220	13	16	206	222	15	16
Other	17	17	18	1	1	16	17	0	1	16	17	0	1

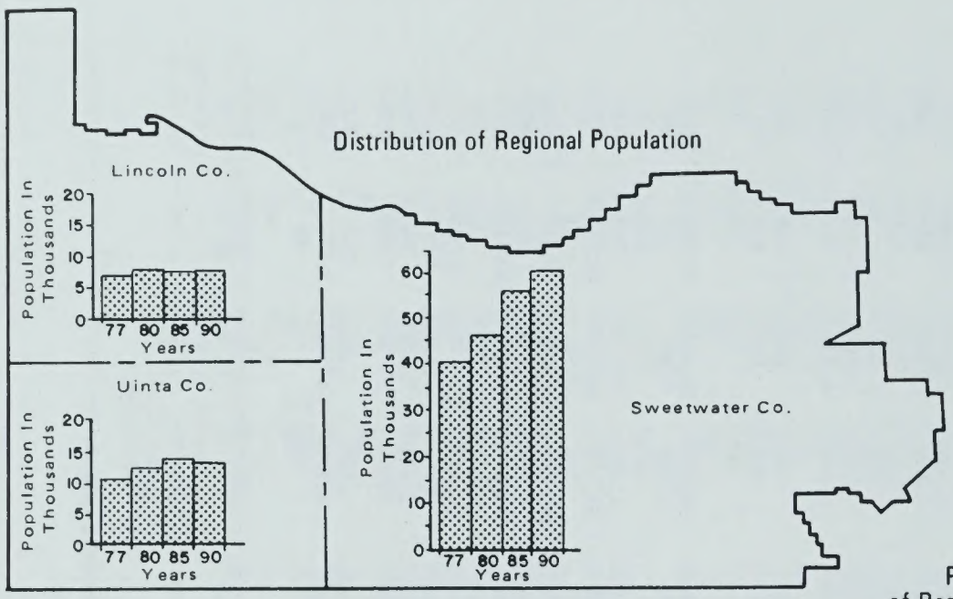
Table R4-15C

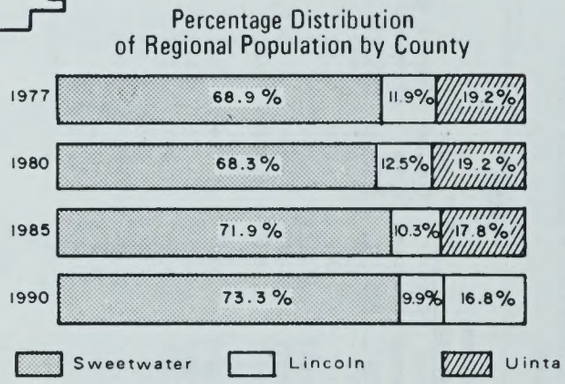
PROJECTED EMPLOYMENT BY SECTOR: SOUTHWESTERN WYOMING ES REGION
(Continued)

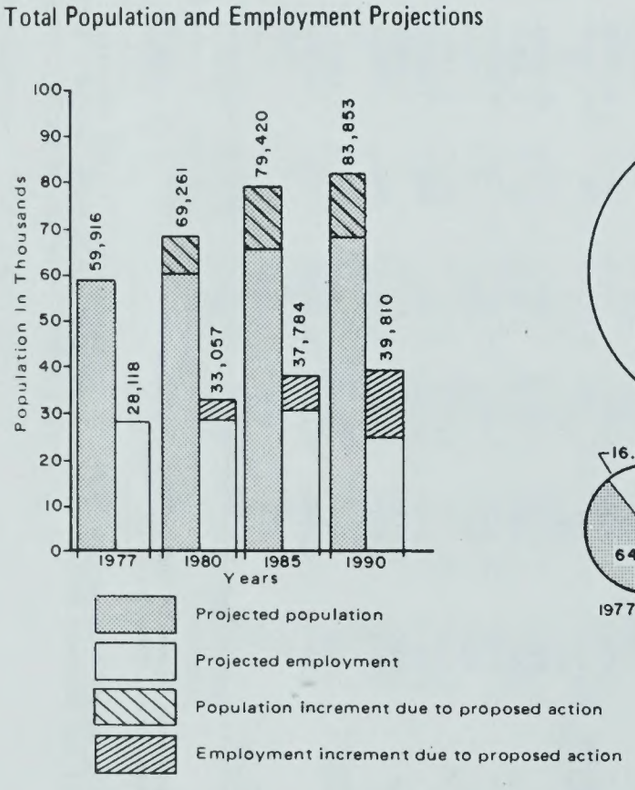
	1977	1980				1985				1990			
		Employment Projection				Employment Projection				Employment Projection			
	Estimated Employment	Without Proposed Action	With Proposed Action	Cumulative Impact	Impact of Proposed Action	Without Proposed Action	With Proposed Action	Cumulative Impact	Impact of Proposed Action	Without Proposed Action	With Proposed Action	Cumulative Impact	Impact of Proposed Action
Uinta County	4,795	5,153	5,558	763	405	5,111	5,957	1,162	846	5,070	5,918	1,123	848
Proprietors	815	626	608	-207	- 18	614	569	-246	- 45	603	559	-256	- 44
Farm	325	242	242	- 83	0	229	229	- 96	0	217	217	-108	0
Nonfarm	490	384	366	-124	- 18	385	340	-150	- 45	386	342	-148	- 44
Wage and salary	3,980	4,527	4,950	970	423	4,497	5,388	1,408	891	4,467	5,359	1,379	892
Farm	142	111	112	- 30	1	111	111	- 31	0	110	110	- 32	0
Nonfarm	3,838	4,416	4,838	1,000	422	4,386	5,277	1,439	891	4,357	5,249	1,411	892
Government	1,383	1,264	1,316	- 67	52	1,256	1,368	- 15	112	1,251	1,364	- 19	113
Private	2,455	3,152	3,522	1,067	370	3,130	3,909	1,454	779	3,106	3,885	1,430	779
Manufacturing	181	288	332	151	44	284	378	197	94	280	373	192	93
Mining	122	510	633	511	123	510	770	648	260	510	770	648	260
Construction	231	210	219	- 12	9	209	227	- 4	18	209	226	- 5	17
Transportation	507	407	411	- 96	4	409	415	- 92	6	408	414	- 93	6
Trade	925	1,113	1,230	305	117	1,101	1,349	424	248	1,090	1,339	414	249
Finance, insurance and real estate	73	85	93	20	8	84	102	29	18	83	101	28	18
Services	411	528	591	180	63	522	653	242	131	516	647	236	131
Other	5	11	13	8	2	11	15	10	4	10	15	10	5
REGIONAL TOTALS	28,118	30,834	33,057	4,939	2,223	34,295	37,784	9,666	3,489	36,313	39,810	11,692	3,497
Proprietors	2,696	2,569	2,612	- 84	43	2,722	2,793	97	71	2,798	2,867	171	69
Farm	710	586	585	-125	- 1	555	555	-155	0	527	525	-185	- 2
Nonfarm	1,986	1,983	2,027	41	44	2,167	2,238	252	71	2,271	2,342	356	71
Wage and salary	25,422	28,265	30,445	5,023	2,180	31,573	34,991	9,569	3,418	33,515	36,943	11,521	3,428
Farm	612	536	537	- 75	1	529	529	- 83	0	522	521	- 91	- 1
Nonfarm	24,810	27,729	29,908	5,098	2,179	31,044	34,462	9,652	3,418	32,993	36,422	11,612	3,429
Government	3,696	4,106	4,265	569	159	4,368	4,662	966	294	4,504	4,798	1,102	294
Private	21,114	23,623	25,643	4,529	2,020	26,676	29,800	8,686	3,124	28,489	31,624	10,510	3,135
Manufacturing	722	969	1,021	299	52	1,070	1,219	497	149	1,131	1,281	559	150
Mining	5,645	8,420	9,251	3,606	831	9,915	11,394	5,749	1,479	10,695	12,178	6,533	1,483
Construction	5,484	2,242	2,726	-2,758	484	2,040	2,199	3,285	159	2,155	2,315	3,169	160
Transportation	1,884	2,118	2,117	233	- 1	2,284	2,393	509	109	2,413	2,527	643	114
Trade	4,206	5,657	5,987	1,781	330	6,523	7,265	3,059	742	7,002	7,751	3,545	749
Finance, Insurance and Real Estate	330	409	424	94	15	442	484	154	42	465	507	177	42
Services	2,787	3,727	4,027	1,240	300	4,306	4,738	1,951	432	4,527	4,951	2,164	424
Other	56	81	90	34	9	96	108	52	12	101	114	58	13

Sources:
1. Wyoming Employment Security Commission.
2. Abt Associates Inc. February 1978.

Note: Cumulative Impact = projection "with" the proposed action - 1977 estimate.
Impact of the Proposed Action = projection "with" the proposed action - projection "without" the proposed action.







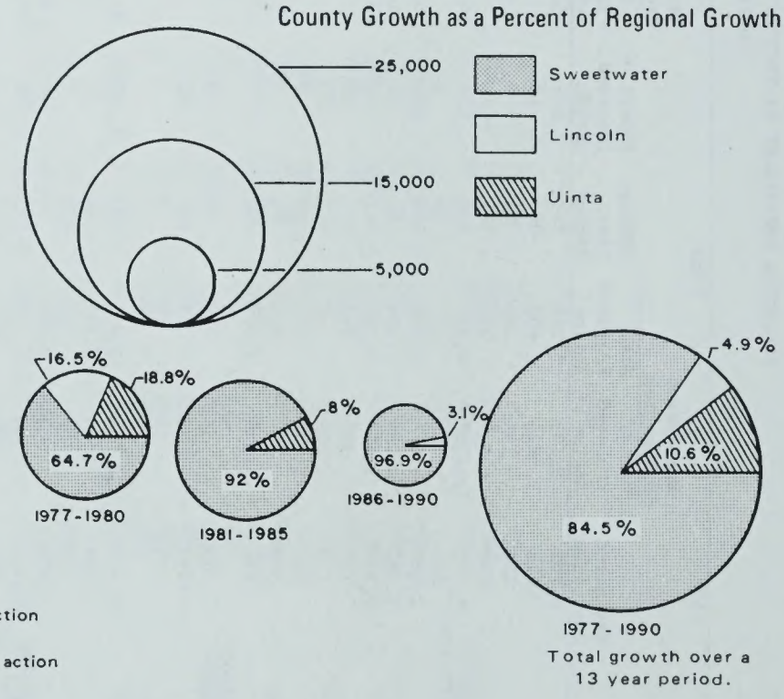


Figure R 4 - 15A

POPULATION DATA

SOUTHWESTERN WYOMING ES REGION

region to increase. Total regional earned income, based upon the cumulative effects described earlier, is projected to increase from an estimated $342.8 million in 1977 to $446.3 million in 1980, $588.7 million in 1985, and $705.5 million in 1990 (Table R4-15D). The proposed actions would cause income to increase by $29.8 million by 1980, $52.9 million by 1985, and $60.6 million by 1990. By 1990, the income resulting from the proposed actions would be nearly 17% of the total new income in the ES region. This would be a significant contribution. Sweetwater County would receive over 67% of the cumulative new income in all three time periods, as shown on Figure R4-15B; however, all three counties would have significant increases in their incomes by 1990 over their 1977 levels: Sweetwater (109%), Lincoln (90%), and Uinta (104%).

It would not be reasonable to address per capita income on a regional basis because of the extremely wide difference between that of Sweetwater and Lincoln Counties and Uinta County. Uinta's per capita income in 1977 ($3,454) was nearly 45% less than the other two counties average of $6,258. All three of them would, however, have significant cumulative increases by 1990: Sweetwater (40%), Lincoln (63%), and Uinta (67%). In spite of Uinta County having the largest percent increase, it would not be able to match the dollar increases of the two more economically active counties. Lincoln County's higher rate of per capita growth would allow it to surpass Sweetwater's figure by 1990 (see Table R4-15D). The proposed actions would not by themselves significantly impact per capita income in the region because of the concurrent increases in population.

Another impact associated with income, as mentioned earlier, would be the disparity between the wages offered employees in the mining and construction sectors (1977 average weekly earnings = $257) and the wages offered in the local service sectors (1977 average weekly earnings = $171). The proposed actions would cause this difference to increase, especially if the mining industry was forced to increase wages even more to attract qualified laborers into the region and specifically into that sector. Also, as wages generally increase in all sectors, the cost of living would increase as experienced in other high growth areas. This would cause persons on low or fixed incomes (poor, retired, and pensioners) to be at an even greater disadvantage when competing for goods, services, and suitable housing (Abt Associates 1977 and 1978).

Infrastructure

Private Sector

Private sector revenues would significantly increase to reflect increases in earned income, employment, and population in the ES region. Retail sales would be 5.7% ($11.8 million), 10% ($30 million), and 9.5% ($39.4 million) greater in 1980, 1985, and 1990, respectively, because of the proposed actions (Table R4-15E). Sweetwater County would capture 75% ($218.7 million) of the cumulative retail income by 1990. Wholesale activity would follow a similar pattern. These sales would be impacted by the proposed actions by causing them to be greater by 5.2% ($3.7 million) by 1980, 9.6% ($9.9 million) by 1985, and 9.2% ($13.1 million) by 1990. Sweetwater County would receive 62% ($8.1 million) of these sales in 1990.

Existing retail development patterns would be reinforced. Evanston, Kemmerer, Rock Springs, and Green River would remain the primary centers of retail trade activity. New, nonbasic industry would be attracted to the region and would locate on the fringes of existing commercial trade centers rather than in existing central business districts. They would likely offer a wider range of goods and services at more competive prices than existing firms. The central business district would, consequently, begin to lose part of its market share to newer firms and would enter a period of decline (Abt Associates 1977).

Public Finance

The impacts of the proposed actions on local governments' finances would vary. In some cases the rapid population and economic growth would be beneficial both in the short and long terms, while in others the long-term effect would be negative. Many impacts would be reduced in significance if front-end monies were made available through existing codes such as the BLM Organic Act of 1976 or the lessening of restrictions placed upon local governments for the use of certain funds that are available to them (i.e., coal impact funds).

Table R4-15F shows projected surpluses or deficits of local governments in the ES region for 1980, 1985, and 1990. During the 1977 to 1980 period, the proposed actions would benefit all the communities shown and Lincoln County by either increasing their surpluses or reducing an expected deficit. Sweetwater County, however, would have a reduced surplus, and Uinta County would have a larger deficit. By 1985, Sweetwater County would be in a temporary surplus condition, but Rock Springs would start a deficit condition that would continue through 1990. Sweetwater County and Rock Springs would have significant deficits by 1990, since they would be forced to increase their services and facilities to cope with their larger populations. It is recognized that Wyoming State law prohibits deficit spending at all levels of government; the deficits shown above are estimates to indicate that short falls in services or revenues would occur if no counter measures were taken.

Housing

The demand for housing would be significantly impacted by the projected increase in the region's population caused by the proposed actions. Housing requirements would be greater by 48.1% (1,964 units) in 1980, 34.9% (2,991 units) in 1985, and 29.6% (3,134 units) in 1990 (Table R4-15G). Nearly 88% (2,991 units) of the new housing requirements caused by the proposal by

Table R4-15D

PROJECTED INCOME: SOUTHWESTERN WYOMING ES REGION

	1977 Estimated Income	1980 Income Projection Without Proposed Actions	1980 Income Projection With Proposed Actions	1980 Cumulative Impact	1980 Impact of Proposed Actions	1985 Income Projection Without Proposed Actions	1985 Income Projection With Proposed Actions	1985 Cumulative Impact	1985 Impact of Proposed Actions	1990 Income Projection Without Proposed Actions	1990 Income Projection With Proposed Actions	1990 Cumulative Impact	1990 Impact of Proposed Actions
Sweetwater County													
Per capita income	$6,263	$6,854	$6,937	$ 674	$ 83	$7,835	$7,846	$1,583	$ 11	$ 8,768	$ 8,777	$2,514	$ 9
Total earned income (millions)	$258.4	$310.6	$328.2	$ 69.8	$ 17.6	$414.9	$448.1	$189.7	$ 33.2	$ 502.3	$ 539.6	$281.2	$ 37.3
Lincoln County													
Per capita income	$6,252	$7,272	$7,496	$1,244	$ 244	$8,646	$8,744	$2,492	$ 98	$10,105	$10,199	$3,947	$ 94
Total earned income (millions)	$ 44.6	$ 56.7	$ 65.0	$ 20.4	$ 8.3	$ 61.6	$ 71.5	$ 26.9	$ 9.9	$ 73.1	$ 84.8	$ 40.2	$ 11.7
Uinta County													
Per capita income	$3,454	$3,975	$3,997	$ 543	$ 22	$4,854	$4,891	$1,437	$ 37	$ 5,724	$ 5,768	$2,314	$ 44
Total earned income (millions)	$ 39.8	$ 49.2	$ 53.1	$ 13.3	$ 3.9	$ 59.3	$ 69.1	$ 29.3	$ 9.8	$ 69.5	$ 81.1	$ 41.3	$ 11.6
Regional Totals													
Total earned income (millions)	$342.8	$416.5	$446.3	$103.5	$ 29.8	$535.8	$588.7	$245.9	$ 52.9	$ 644.9	$ 705.5	$362.7	$ 60.6

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 estimate.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

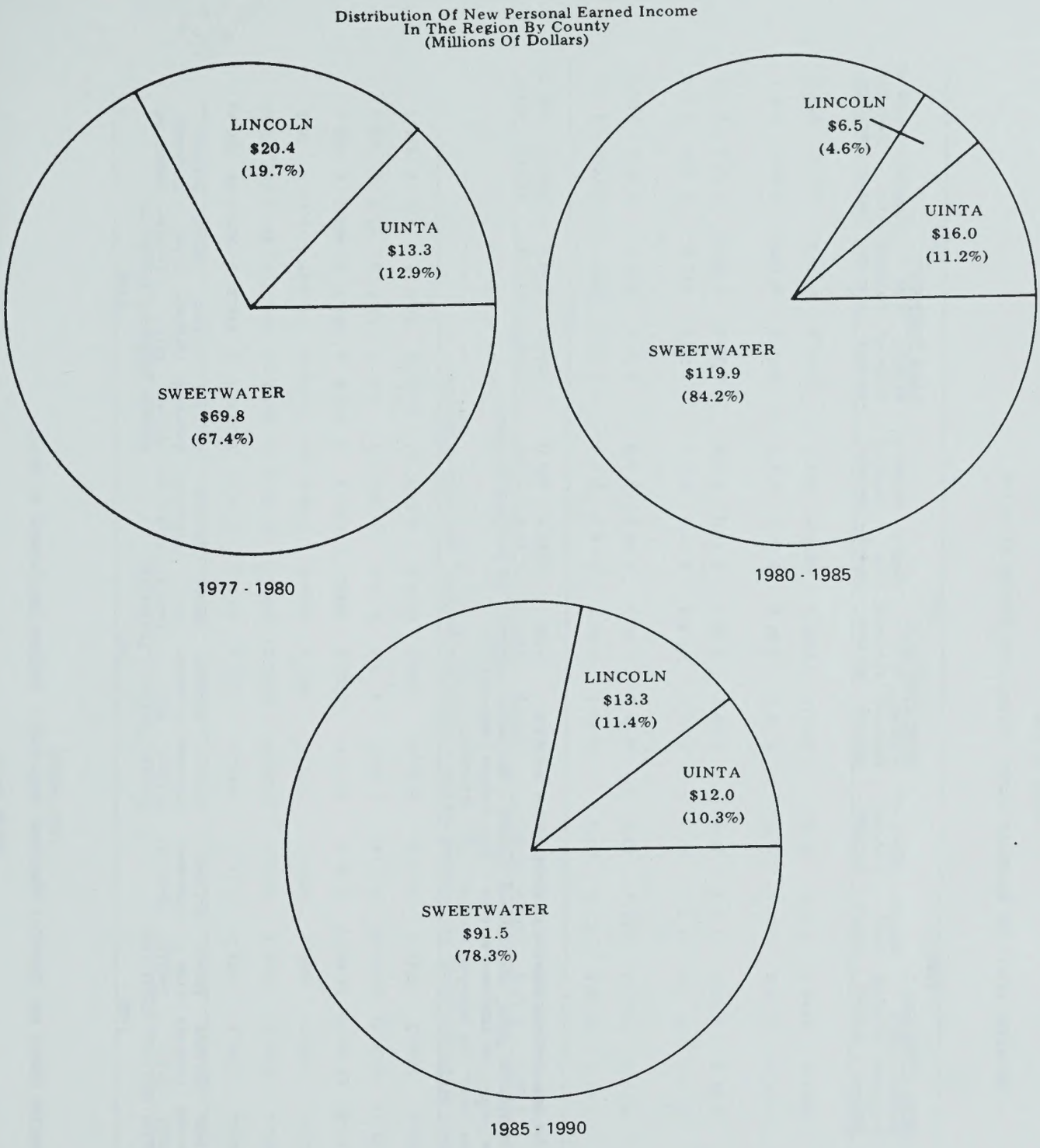


Figure R 4 - 15B

PROJECTED TOTAL PERSONAL EARNED INCOME:
SOUTHWESTERN WYOMING ES REGION

Table R4-15E

PROJECTED RETAIL AND WHOLESALE SALES: SOUTHWESTERN WYOMING ES REGION

	1977 Estimated Income	1980 Sales Projection - Without Proposed Actions	1980 Sales Projection - With Proposed Actions	1980 Cumulative Impact	1980 Impact of Proposed Actions	1985 Sales Projection Without Proposed Actions	1985 Sales Projection With Proposed Actions	1985 Cumulative Impact	1985 Impact of Proposed Actions	1990 Sales Projection Without Proposed Actions	1990 Sales Projection With Proposed Actions	1990 Cumulative Impact	1990 Impact of Proposed Actions
Sweetwater County													
Retail sales	$110.2	$141.9	$148.1	$37.9	$6.2	$217.1	$234.2	$124.0	$17.1	$306.5	$328.9	$218.7	$22.4
Wholesale sales	$ 39.9	$ 51.4	$ 53.6	$13.7	$2.2	$ 78.6	$ 84.8	$ 44.9	$ 6.2	$110.9	$119.0	$ 79.1	$ 8.1
Lincoln County													
Retail sales	$ 17.3	$ 22.2	$ 24.6	$ 7.3	$2.4	$ 26.4	$ 30.3	$ 13.0	$ 3.9	$ 35.1	$ 40.3	$ 23.0	$ 5.2
Wholesale sales	$ 5.6	$ 7.2	$ 7.9	$ 2.3	$0.7	$ 8.5	$ 9.8	$ 4.2	$ 1.3	$ 11.3	$13.0	$ 7.4	$ 1.7
Uinta County													
Retail sales	$ 35.1	$ 44.3	$ 47.5	$12.4	$3.2	$ 57.0	$ 66.0	$ 30.9	$ 9.0	$ 74.1	$85.9	$ 50.8	$11.8
Wholesale sales	$ 9.6	$ 12.2	$ 13.0	$ 3.4	$0.8	$ 15.7	$ 18.1	$ 8.5	$ 2.4	$ 20.3	$23.6	$ 14.0	$ 3.3
Regional Totals													
Retail sales	$162.6	$208.4	$220.2	$57.6	$11.8	$300.5	$330.5	$167.9	$30.0	$415.7	$455.1	$292.5	$39.4
Wholesale sales	$ 55.1	$ 70.8	$ 74.5	$19.4	$ 3.7	$102.8	$112.7	$ 57.6	$ 9.9	$142.5	$155.6	$100.5	$13.1

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 estimate.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

Table R4-15F

PROJECTED COUNTY AND COMMUNITY SURPLUSES (DEFICITS): SOUTHWESTERN WYOMING ES REGION
(thousands)

	1977 Surplus (Deficit)	1980 Surplus (Deficit) Projection				1985 Surplus (Deficit) Projection				1990 Surplus (Deficit) Projection			
		Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions
Sweetwater County	0	$251.8	$235.2	$235.2	($ 16.6)	$697.5	$757.5	$757.5	$ 60.6	$1,090.7	$ 930.3	$ 903.3	($ 160.4)
Rock Springs	0	$593.0	$769.8	$769.8	$176.8	($164.5)	($240.2)	($240.2)	($ 75.7)	($ 143.7)	($1,297.1)	($1,297.1)	($1,153.4)
Green River	0	$245.4	$405.9	$405.9	$160.5	$132.7	$222.6	$222.6	$ 89.9	($ 36.7)	($ 4.0)	($ 4.0)	$ 32.7
Lincoln County[1]	0	($107.6)	($ 80.7)	($ 80.7)	$ 26.9	$127.9	$293.7	$293.7	$165.8	$ 219.4	$ 407.7	$ 407.7	$ 188.3
Uinta County[1]	0	($ 25.1)	($109.2)	($109.2)	($ 84.1)	$ 26.2	$ 9.3	$ 9.3	($ 16.9)	$ 6.2	$ 53.5	$ 53.5	$ 47.3
Evanston	0	$151.3	$224.9	$224.9	$ 73.6	$ 41.8	$174.5	$174.5	$132.7	($ 43.5)	$ 92.0	$ 92.0	$ 135.5

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 surplus (deficit).
Impact of Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

[1]Kemmerer, Lyman, and Mountain View are not examined because of insufficient data.

Table R4-15G

PROJECTED HOUSING DEMAND: SOUTHWESTERN WYOMING ES REGION

	1977 Housing Units	1980 Housing Projection Without Proposed Actions	1980 Housing Projection With Proposed Actions	1980 Cumulative Impact	1980 Impact of Proposed Actions	1985 Housing Projection Without Proposed Actions	1985 Housing Projection With Proposed Actions	1985 Cumulative Impact	1985 Impact of Proposed Actions	1990 Housing Projection Without Proposed Actions	1990 Housing Projection With Proposed Actions	1990 Cumulative Impact	1990 Impact of Proposed Actions
Sweetwater County[1]													
Total	10,367	12,062	13,000	2,633	938	15,381	17,281	6,914	1,900	17,245	19,288	8,921	2,043
Rock Springs	5,197	6,265	6,873	1,676	608	8,356	9,586	4,389	1,230	9,530	10,853	5,656	1,323
Single-family	3,199	3,840	4,144	945	304	5,094	5,709	2,510	615	5,799	6,461	3,262	662
Multi-family	622	782	873	251	91	1,096	1,281	659	185	1,272	1,470	848	198
Mobile homes	1,376	1,643	1,856	480	213	2,166	2,596	1,220	430	2,459	2,922	1,546	463
Green River	3,312	3,826	4,087	775	261	4,831	5,360	2,048	529	5,396	5,965	2,653	569
Single-family	1,783	2,117	2,248	465	131	2,771	3,036	1,253	265	3,138	3,423	1,640	285
Multi-family	467	529	568	101	39	649	728	261	79	717	802	335	85
Mobile homes	1,062	1,180	1,271	209	91	1,411	1,596	534	185	1,541	1,740	678	199
Balance	1,858	1,971	2,040	182	69	2,194	2,335	477	141	2,319	2,470	612	151
Single-family	573	635	666	93	31	758	821	248	63	827	895	322	68
Multi-family	82	88	91	9	3	99	106	24	7	105	113	31	8
Mobile homes	1,203	1,248	1,283	80	35	1,337	1,408	205	71	1,387	1,462	259	75
Lincoln County[1]													
Total	NA	NA	NA	503	331	NA	NA	714	396	NA	NA	714	396
Kemmerer/ Diamondville	1,444	1,532	1,832	388	300	1,607	1,966	522	359	1,607	1,966	522	359
Single-family	729	782	932	203	150	827	1,007	278	180	827	1,007	278	180
Multi-family	303	315	357	54	42	326	376	73	50	326	376	73	50
Mobile homes	412	435	543	131	108	454	583	171	129	454	583	171	129
Balance	NA	NA	NA	115	31	NA	NA	192	37	NA	NA	192	37
Single-family	NA	NA	NA	71	17	NA	NA	121	20	NA	NA	121	20
Multi-family	NA	NA	NA	16	4	NA	NA	27	5	NA	NA	27	5
Mobile homes	NA	NA	NA	28	10	NA	NA	44	12	NA	NA	44	12

Table R4-15G

PROJECTED HOUSING DEMAND: SOUTHWESTERN WYOMING ES REGION
(Continued)

	1977 Housing Units	1980 Housing Projection Without Proposed Actions	1980 Housing Projection With Proposed Actions	1980 Cumulative Impact	1980 Impact of Proposed Actions	1985 Housing Projection Without Proposed Actions	1985 Housing Projection With Proposed Actions	1985 Cumulative Impact	1985 Impact of Proposed Actions	1990 Housing Projection Without Proposed Actions	1990 Housing Projection With Proposed Actions	1990 Cumulative Impact	1990 Impact of Proposed Actions
Uinta County													
Total	NA	NA	NA	951	695	NA	NA	951	695	NA	NA	951	695
Evanston	1,568	1,699	2,189	621	490	1,699	2,189	621	490	1,699	2,189	621	490
Single-family	1,064	1,147	1,374	310	227	1,147	1,374	310	227	1,147	1,374	310	227
Multi-family	198	212	285	87	73	212	285	87	73	212	285	87	73
Mobile homes	306	340	530	224	190	340	530	224	190	340	530	224	190
Lyman	507	560	682	175	122	560	682	175	122	560	682	175	122
Single-family	196	220	257	61	37	220	257	61	37	220	257	61	37
Multi-family	13	16	22	9	6	16	22	9	6	16	22	9	6
Mobile homes	298	324	403	105	79	324	403	105	79	324	403	105	79
Mountain View	219	234	265	46	31	234	265	46	31	234	265	46	31
Single-family	120	130	145	25	15	130	145	25	15	130	145	25	15
Multi-family	0	1	3	3	2	1	3	3	2	1	3	3	2
Mobile homes	99	103	117	18	14	103	117	18	14	103	117	18	14
Balance	NA	NA	NA	109	52	NA	NA	109	52	NA	NA	109	52
Single-family	NA	NA	NA	63	26	NA	NA	63	26	NA	NA	63	26
Multi-family	NA	NA	NA	12	5	NA	NA	12	5	NA	NA	12	5
Mobile homes	NA	NA	NA	34	21	NA	NA	34	21	NA	NA	34	21
Summary of total housing by county													
Sweetwater County[1]	10,367[2]	12,062[2]	13,000[2]	2,633	938	15,381[2]	17,281[2]	6,914	1,900	17,245[2]	19,288[2]	8,921	2,043
Lincoln County[1]	1,444[2]	1,532[2]	1,832[2]	503	331	1,607[2]	1,966[2]	714	396	1,607[2]	1,966[2]	714	396
Uinta County	2,294[2]	2,493[2]	3,136[2]	951	695	2,493[2]	3,136[2]	951	695	2,493[2]	3,136[2]	951	695
Regional totals[2]	14,105[2]	16,087[2]	17,968[2]	4,087	1,964	19,481[2]	22,383[2]	8,579	2,991	21,345[2]	24,390[2]	10,586	3,134

Source: Abt Associates 1978.

Notes: Projected balance of county housing needs in Lincoln and Uinta Counties are not available because base year (1977) data are not available.

[1] That portion of the county in the ES region.

[2] Data are not complete; impacts will not track.
Cumulative Impact = projection "with" the proposed actions - 1977 housing.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

NA = Not available.

1990 would be in the region's four major communities. Rock Springs would be most severely impacted with over 42% (1,323 units) of these requirements.

If the housing construction industry could not keep pace with projected demands, the current housing shortage would be further aggravated. The cost of housing would continue to inflate, and residents would be forced to turn to less desirable dwellings such as mobile homes. The crowded conditions and lack of services available in scattered and unplanned mobile-home parks have resulted in numerous social problems (i.e., marital problems, alcholism, etc.) in other high growth areas (Gilmore and Duff 1975). This could also occur in the region if no measures are taken to plan and regulate housing developments. Increased housing demands would also require more land area for residential development and greater expenditures by local governments to provide streets, sewage, and other facilities. Government expenditure increases would be moderated in the long term by greater revenues coming to them through taxes on higher assessed valuations and other tax revenues.

Education

Population growth would cause increases in the enrollments of all school districts in the ES region (Table R4-15H). It would climb from 11,390 students in 1977 to 16,243 students in 1990. The impact of the proposed actions would be 856 more students in 1980, 1,552 in 1985, and 1,195 in 1990.

School District 01 and 02 in Sweetwater County would require 30 additional classrooms to accommodate the increase in enrollment caused by the proposed actions. Cumulative growth would require another 222 teachers and 198 classrooms over current levels to maintain existing student/teacher ratios and classroom conditions. Rock Springs District 01 would be in a surplus financial position by 1990, while Green River District 02 would have a significant deficit situation.

The Kemmerer/Diamondville District 01 would require an additional 10 teachers and 8 classrooms by 1990 because of the proposed actions. Impacts to this district would not be significant, and it would be in a surplus financial position through 1990.

The three school districts in Uinta County would need a total of 21 additional teachers and 21 additional classrooms by 1990 because of the proposed actions. While Evanston District 01 would have nearly 75% of county school requirements, only Mountain View District 04 would be in a deficit financial position by 1990.

Regionwide, there could be significant problems recruiting teachers needed by the larger school operations. This would be especially true in Uinta County where recruiting problems have been complicated by the current housing shortage. Prospective teachers cannot find adequate housing which deters them from relocating to the area (Abt Associates 1977). Specific information on requirements for all school districts in the ES region is available for review at the Rock Springs District Office of the BLM.

Health Care and Social Services

The proposed actions would not significantly impact health care requirements in the ES region. Cumulative growth would, however, cause significant shortages in professional personnel, especially in Sweetwater County. This county would need 6 more doctors and 6 more dentists in addition to other requirements by 1990 (Table R4-15I) to provide adequate services. While actual numbers of professional personnel requirements do not appear high, they are significant because recruitment of these individuals has been difficult. Similar high-growth areas have incurred costs approaching $30,000 to recruit individual professionals.

Sweetwater County would also have the most significant impacts on social service requirements. It would need 3 additional social workers by 1990 to handle an expected increase in cases primarily involving family problems, child abuse, child neglect, and abandonment (Abt Associates 1978 and Gilmore 1975). The trend of increasing public income assistance cases experienced in the region during fiscal year 1974-1976 period would continue. The underlying dynamics of speculative price increases, declines in the relative standard of living of lower- and fixed-income residents, and family instability would lead more people to request food stamps, aid to families with dependent children, emergency, general relief, and medical vendor payment assistance (Abt Associates 1977).

Law Enforcement

From 1976 to 1980, when growth would be most rapid in the region, the influx of temporary employees and their families would lead to sharp increases in criminal activity in the region (Abt Associates 1977). This has occurred in other areas and is a result of the transitory nature of this group. Additional traffic would also lead to more frequent minor violations and accidents. Growth during the 1981 to 1990 period would include more permanent mining employees and their dependents who, because they would have a greater stake in the community, would probably bring it greater stability.

There would be a significant increase in the amount of required law enforcement officers in the ES region. It would be necessary to increase their numbers from 127 in 1977 to 149 in 1980, 168 in 1985, and 179 in 1990 (Table R4-15J). The proposed actions would be directly responsible for approximately 37% (19 officers) of the increases by 1990. Sweetwater County, Rock Springs, and Green River would be most significantly affected since they would require 75% (39 officers) of the cumulative additional officers required in the region. Difficulties in recruiting qualified officers and the additional public expense to hire them add to the significance of this impact. The proposed actions would also require a significant increase in the number of additional vehicles used by law enforcement officials in the region: five in 1980, eight in 1985, and eight in 1990. The number of judges in the region would also have to be increased to meet larger

Table R4-15H

PROJECTED SCHOOL ENROLLMENT: SOUTHWESTERN WYOMING ES REGION

	1977 Fall Enrollment	1980 Enrollment Projection				1985 Enrollment Projection				1990 Enrollment Projection			
		Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions
Sweetwater County													
Rock Springs #1	4,903	5,411	5,625	722	214	6,462	7,029	2,126	567	7,042	7,397	2,494	355
Green River #2	3,052	3,607	3,750	698	143	4,308	4,686	1,634	378	4,695	4,931	1,879	236
Lincoln County													
Kemmerer/ Diamondville	912	1,049	1,347	435	298	879	1,042	130	163	890	1,064	152	174
Uinta County													
Evanston #1	1,249	1,373	1,487	238	114	1,223	1,567	318	344	1,150	1,469	220	319
Lyman #6	677	708	746	69	38	680	764	87	84	670	761	84	91
Mountain View #4	597	571	620	23	49	594	610	13	16	601	621	24	20
Regional totals	11,390	12,719	13,575	2,185	856	14,146	15,698	4,308	1,552	15,048	16,243	4,853	1,195

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 enrollemnt.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

Table R4-15I

PROJECTED HEALTH AND SOCIAL SERVICE NEEDS: SOUTHWESTERN WYOMING ES REGION

	1977 Personnel and Facilities	1980 Health Care Projection				1985 Health Care Projection				1990 Health Care Projection			
		Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions
Sweetwater County													
Physicians	14	15	16	2	1	17	19	5	2	19	20	6	1
Dentists	13	14	15	2	1	17	18	5	1	18	19	6	1
Hospital beds	97	106	111	14	5	124	134	37	10	135	145	48	10
Ambulances	9	10	10	1	0	12	12	3	0	12	13	4	1
Public health nurses	8	9	9	1	0	10	11	3	1	11	12	4	1
Social workers	7	8	8	1	0	9	10	3	1	10	10	3	0
Lincoln County													
Physicians	3	4	4	1	0	4	4	1	0	4	4	1	0
Dentists	3	3	4	1	1	3	3	0	0	3	3	0	0
Hospital beds	20	22	24	4	2	20	23	3	3	20	23	3	3
Ambulances	5	5	6	1	1	5	6	1	1	5	6	1	1
Public health nurses	1	1	1	0	0	1	1	0	0	1	1	0	0
Social workers	1	1	1	0	0	1	1	0	0	1	1	0	0
Uinta County													
Physicians	4	4	5	1	1	4	4	0	0	4	4	0	0
Dentists	3	3	3	0	0	3	4	1	1	3	4	1	1
Hospital beds	22	24	25	3	1	23	27	5	4	23	27	5	4
Ambulances	5	5	6	1	1	5	6	1	1	5	6	1	1
Public health nurses	1	1	1	0	0	1	1	0	0	1	1	0	0
Social workers	1	1	1	0	0	1	1	0	0	1	1	0	0

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 personnel or facility.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

Table R4-15J

PROJECTED LAW ENFORCEMENT PERSONNEL NEEDS: SOUTHWESTERN WYOMING ES REGION

	1977 Law Enforcement Personnel	1980 Personnel Projection		1980 Cumulative Impact	1980 Impact of Proposed Actions	1985 Personnel Projection		1985 Cumulative Impact	1985 Impact of Proposed Actions	1990 Personnel Projection		1990 Cumulative Impact	1990 Impact of Proposed Actions
		Without Proposed Actions	With Proposed Actions			Without Proposed Actions	With Proposed Actions			Without Proposed Actions	With Proposed Actions		
Sweetwater County	25	27	29	4	2	32	35	10	3	35	38	13	3
Rock Springs	33	36	38	5	2	42	46	13	4	46	49	16	3
Green River	21	23	24	3	1	27	29	8	2	29	31	10	2
Balance of county	N/A												
Lincoln County	17	19	20	3	1	17	19	2	2	17	20	3	3
Kemmerer/ Diamondville	9	10	12	3	2	9	11	2	2	9	12	3	3
Balance of county	N/A												
Uinta County	7	8	9	2	1	8	9	2	1	8	9	2	1
Evanston	11	12	13	2	1	12	14	3	2	12	15	4	3
Lyman	3	3	3	0	0	3	4	1	1	3	4	1	1
Mountain View	1	1	1	0	0	1	1	0	0	1	1	0	0
Balance of county	N/A												
Regional Totals	127	139	149	22	10	151	168	41	17	160	179	52	19

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 personnel.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

N/A = Not Applicable

case loads. Eight more would be needed by 1990, with five of them caused by the proposed actions.

Fire Protection

The need for additional fire protection would follow the pattern of residential growth in the region. Requirements for personnel in the ES region would increase from 165 in 1977 to 194 in 1980, 217 in 1985, and 226 in 1990 (Table R4-15K). The impact of the proposed actions would be moderately significant in the region's four major communities. Evanston would be most affected, as it would need 9 additional personnel by 1985. While specific information is not available, additional equipment would also be required. Without improvements to existing water systems, nearly all communities in the region would have insufficient fire flows as early as 1980 (specific information available at the Rock Springs District Office of the BLM).

Public Utilities

Projected regional growth would not cause the demand for water to exceed current plant design capacities. Table R4-15L shows projected sewer system daily treatment requirements in the ES region. Cumulative population growth would cause all communities except Green River and Lyman to have treatment demands that exceed current plant capacity. The impact of the proposed actions would not be significant in most communities, but they would add to over capacity problems. By 1985, Evanston's capacity would be exceeded as a direct result of the proposed actions. Telephone, gas, and electricity requirements would also increase; however, company officials do not predict any problems meeting projected demands (Abt Associates 1978). Specific information on all public utilities is available for review at the Rock Springs District Office of the BLM.

Attitudes and Expectations

Economic benefits resulting from approval of the proposed actions would fulfill the expectations of many residents that energy development would have a position influence on the region. Long-term residents of the region who have known their communities during periods of less intense activity would be more negatively concerned about the effects of further growth than newer residents would be.

Some residents in the region would be expected to be more optimistic about their community's ability to respond to the additional growth than the residents of other towns. Green River and Rock Springs have already begun improvements on their social infrastructure in response to earlier growth. Although they would face an additional financial burden with additional growth, they have established a process for planning for the future that should encourage optimism.

The residents of Lincoln County, who are expected to be concerned about growth already anticipated, would be somewhat pessimistic when faced with the increase in growth projected with further coal development. In Uinta County, Evanston residents, who are confident in the leadership of their community and who feel that more growth would only help their town, would welcome the additional growth. However, the pessimism concerning future growth, as expressed by Kemmerer residents, would continue if the proposed actions are approved, because this community would experience a significant growth increase.

Life Styles

With the proposed actions, the quality of life in the region would not, in most cases, be significantly different than the quality of life experienced without it. The Kemmerer/Diamondville area would undergo some deterioration in the quality of services and facilities through the rapid growth period (1978-1980). Conditions may also worsen in Evanston, Lyman, Green River, and Rock Springs before the growth rate begins to decline. Once there is a slowdown in the rate of population growth, the quality of life would begin to improve. It would gradually return to or exceed the standard of earlier years. Community sizes would increase and some of the small-town atmosphere would be lost. Noise pollution resulting from increased rail and motor vehicle traffic would degrade the quiet, rural lifestyle, but it would probably not be significant. While these impacts are not quantifiable, some residents would undoubtedly feel the loss of what they consider to be a rewarding life style.

Table R4-15K

PROJECTED FIRE PROTECTION NEEDS: SOUTHWESTERN WYOMING ES REGION

	1977 Fire Protection Personnel	1980 Personnel Projection				1985 Personnel Projection				1990 Personnel Projection			
		Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions
Sweetwater County	N/A												
Rock Springs	26	29	30	4	1	34	36	10	2	36	39	13	3
Green River	31	34	35	4	1	40	43	12	3	43	46	15	3
Balance of county	17	19	20	3	1	22	26	9	4	24	28	11	4
Lincoln County	N/A												
Kemmerer/ Diamondville	24	26	32	8	6	26	30	6	4	26	31	7	5
Balance of county	NA												
Uinta County	N/A												
Evanston	39	42	46	7	4	41	50	11	9	41	50	11	9
Lyman	14	15	16	2	1	15	17	3	2	15	17	3	2
Mountain View	14	15	15	1	0	15	15	1	0	15	15	1	0
Balance of county	NA												
Regional Totals	165	180	194	29	14	193	217	52	24	200	226	61	26

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 personnel.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

N/A = Not Applicable.
NA = Not Available.

Table R4-15L

PROJECTED SEWER SYSTEM DAILY TREATMENT REQUIREMENTS: SOUTHWESTERN WYOMING ES REGION
(Millions of Gallons Per Day)

	1977	1980				1985				1990			
	Daily Treatment (Plant Design Capacity)	Treatment Projection Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Treatment Projection Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions	Treatment Projection Without Proposed Actions	With Proposed Actions	Cumulative Impact	Impact of Proposed Actions
Sweetwater County	N/A												
Rock Springs	1.60 (2.00)	1.76	1.80	0.20	0.40	2.05	2.20	0.60	0.15	2.22	2.40	0.80	0.18
Green River	1.00 (1.50)	1.10	1.10	0.10	0.00	1.28	1.30	0.30	0.02	1.39	1.40	0.40	0.01
Balance of county	N/A												
Lincoln County	N/A												
Kemmerer/ Diamondville	0.67 (0.50)	0.73	0.87	0.20	0.14	0.66	0.84	0.17	0.18	0.67	0.85	0.18	0.18
Balance of county	N/A												
Uinta County	N/A												
Evanston	1.69 (1.80)	1.81	1.99	0.30	0.18	1.79	2.17	0.48	0.38	1.79	2.16	0.47	0.37
Lyman	0.32 (0.40)	0.34	0.36	0.04	0.02	0.34	0.38	0.06	0.04	0.34	0.38	0.06	0.04
Mountain View	0.08[1] (0.70)	0.09	0.09	0.01	0.00	0.09	0.10	0.02	0.01	0.09	0.10	0.02	0.01
Balance of county	N/A												

Source: Abt Associates 1978.

Note: Cumulative Impact = projection "with" the proposed actions - 1977 daily treatment.
Impact of the Proposed Actions = projection "with" the proposed actions - projection "without" the proposed actions.

[1]Since Mountain View presently relies on individual septic systems, the 1977 figure is an estimate of the total daily requirements. It was obtained by taking an average of 122 gallons per capita per day times the current population. Mountain View's sewage system, currently under construction, will be operational in 1978.

N/A = Not Applicable

CHAPTER 5

ANY ADVERSE IMPACTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

This chapter presents a summary of the residual adverse impacts that would remain after considering the planning and environmental controls discussed in Chapter 3.

AIR QUALITY

The proposed mining cannot be performed without generating fugitive dust. On a regional basis, estimates indicate that primary and secondary National Ambient Air Quality Standards (NAAQS) for annual and 24-hour total suspended particulate (TSP) concentrations as well as the Class II increments of Prevention of Significant Deterioration (PSD) with the proposed actions would not be exceeded. However, the 24-hour NAAQS could be exceeded in three small areas within the region (Rock Springs, Point of Rocks, and Kemmerer) due to cumulative impacts of the proposed mining and the existing high background TSP concentrations in close proximity. Note that under the new PSD regulations (43 CFR 118), these violations do not occur. In fact, the surface mines are well within the applicable NAAQS and PSD regulations.

Estimates indicate that the Class II PSD allowable TSP increments would be exceeded near proposed mining locations. Again, with the application of the 43 CFR 118 regulations, the violations of the Class II increment will not occur.

Visibility would be reduced regionwide from 40 to about 35 miles on an annual basis. Visibility could be decreased by as much as 71% (from 40 to 12 miles) in the mining areas and 13% (from 40 to 35 miles) regionally. This would occur during the assumed worst-case 24-hour meteorological conditions which would occur on at least 2 days per year.

GEOLOGY

Paleontology

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The significance of this impact cannot be presently meaningfully assessed due to the lack of data and evaluatory criteria.

SOILS

Mining would cause a short-term reduction in soil productivity on 11,785 acres. There would be a total cumulative loss of soil productivity on 18,480 acres by 1990.

Construction of housing and support facilities to accommodate increased population would remove 2,000 acres of soil from productivity.

The increased recreation in the region would result in an unknown amount of soil loss.

If a 25- or 100-year flood occurred when mined areas are in the process of being reclaimed, large amounts of soil loss could considerably lengthen the time required for vegetation reestablishment.

WATER RESOURCES

Water levels in aquifers near mining operations would be lowered and some springs would dry up. Thus, some users would be deprived of water. This loss must be replaced by the mining company.

Trace elements, arsenic, chromium, lead, manganese, mercury, and selenium, may be leached from replaced overburden, thus lowering the quality of ground water. This could occur if zones containing toxic elements were not identified, and replaced overburden containing toxic elements were not buried above the saturated zone and at least 5 feet below the ground surface.

The diversion of water for municipal and municipal-supplied industrial use by 1990 would increase by 86,351 acre-feet per year. Of this, 5,040 acre-feet per year would be due to the proposed actions. This would result in an increased load of dissolved solids downstream from the points of diversion.

Discharge of sewage from towns would increase, and bacterial and dissolved mineral load would increase if the 1977 treatment level is maintained. This could be a significant impact below towns discharging untreated or partially treated sewage to streams. Use of streams for fisheries would be impacted, and the total dissolved solids load of streams would be increased.

VEGETATION

Native vegetation would be removed and vegetative production lost on approximately 15,917 acres by 1990

due to the proposed actions. This would be in addition to the 49,235 acres of vegetation removed in the region due to other activities.

Approximately 7,046 acres of land disturbed by the proposed actions would be unreclaimed by 1990, while 29,595 acres of land disturbed by other activities would be unreclaimed. Reclaimed areas would have a general aspect of grassland with shrub density below premined levels for an estimated 30 to 50 years.

Reclaimed lands, prior to extensive natural succession, would require intensive management to prevent overgrazing.

FISH AND WILDLIFE

Increased human activity would impact many species of wildlife through harrassment, off-road vehicle use, and illegal shooting.

Wildlife habitat and carrying capacity would be lost on 15,917 acres as a direct result of the proposed actions. Approximately 71,626 acres would be indirectly affected (area of influence). Total cumulative regional loss of habitat and carrying capacity would be 65,152 acres as a direct result of the proposed actions and other activities, and 293,184 acres would be indirectly affected.

Specific losses to seasonal ranges of sage grouse, pronghorn antelope, mule deer, elk, and moose from the proposed actions and the losses relationship to the total regional range available are shown in Table R4-8D.

The loss of an estimated 112,400 small nongame birds, 8,200 sage grouse, 1,200 raptors, 13.5 million small nongame mammals, 1,370 antelope, 850 deer, 160 elk, 20 moose, and 125,000 reptiles and amphibians; the habitat and population losses would be of major significance to localized populations, but when compared to total habitat and populations within the region or herd/management unit they would be of minor significance. However, in some cases current data may be insufficient to accurately analyze the effects of each individual habitat or population loss.

Estimated total wildlife population losses from the proposed actions and their relationship to the total regional wildlife populations are shown in Table R4-8C. Also included in Table R4-8C are the projected total cumulative population losses from all regional activities.

Reclamation, if successful, would mitigate some of the above losses. Quantification of such mitigation, however, is not possible with current knowledge and available information (see discussion of reclamation in Regional, Fish and Wildlife and Vegetation sections).

CULTURAL RESOURCES

With destruction of the 91 known archeological sites threatened with complete physical destruction by the proposed actions, some of the information contained in the sites would be lost.

All archeological resources within the environmental statement (ES) region would be affected by increased pothunting and vandalism. This could potentially remove important surface indications of significant buried sites, reducing the chances of these sites being discovered. There would be an estimated total of 301 sites threatened with complete destruction in the region by all activities by 1990. The significance of this loss cannot be determined until the location and nature of these disturbances are known.

Those historical sites threatened with complete physical destruction would have similar adverse impacts and losses as to archeological sites. However, the greatest resultant impact to historical sites would be the loss of integrity by changing their original setting.

VISUAL RESOURCES

Impacts from the proposed actions for access roads, railroads, power lines, pipelines, and other structures would change Visual Resource Management (VRM) Classes II, III, and IV areas to Class V. Impacts would remain until structures are removed and areas revegetated.

Strip mined areas would change VRM Classes II, III, and IV areas to Class V. This impact would remain until there is extensive natural plant succession on reclaimed areas. The change in VRM classes would mean the activities would not meet BLM's management objectives for those higher quality classes.

RECREATIONAL RESOURCES

Increased numbers of recreationists would lower the quality of the "primitive"recreation experience. Increased use would create conflicts between recreationists and landowners; this could result in some landowners restricting access across their lands. The existing recreation facilities would become overcrowded. This would create a need to upgrade existing facilities and to construct new recreational facilities.

AGRICULTURE

There would be an estimated 9,333 animal unit months (AUMs) lost by 1990 due to the proposed actions. The AUMs lost would represent but a small fraction of the total AUMs available in the ES region.

MINERAL RESOURCES

Approximately 84 million tons of coal would not be recovered due to the inherent losses in mining methods used to produce the 353 million tons of economically

minable coal. An unknown quantity in the overburden and (or) interburden would be lost. This coal would be in seams too thin or of too low a quality to be of economic interest.

TRANSPORTATION NETWORKS

Increased license tab sales due to population increase as a result of the proposed actions would be 9% of the 76,300 in the region by 1990. The increased traffic would create additional road maintenance costs due to deterioration of roads.

Relocation of existing roads and construction of railroad spur lines would create inconveniences and poor travel conditions for motorists who pass through these construction areas.

There would be an increase in the number of trains (Table R4-14B) passing through the region which would increase the total train emissions (Table R4-14C) and size of noise corridors (Table R4-14D) through the region. The increased traffic volume would also shorten the time until the track segments would have to be upgraded, especially between Gibbon and North Platte, where rail volume would exceed estimated capacity.

SOCIOECONOMIC CONDITIONS

While an increase in population may not necessarily be adverse, the impact of population growth may generate negative effects. The proposed actions would increase the regional population by a projected 3,761 by 1980, 7,135 by 1985, and 7,199 by 1990. The total cumulative population is projected to be 69,261 in 1980, 79,420 in 1985, and 83,853 in 1990. The rate of growth of the region would be in excess of 5% per year during the 1978 to 1980 period, which could create some indirect over-population impacts. Rock Springs, Green River, Evanston, and Kemmerer/Diamondville would receive approximately 86% (6,225 persons) of the region's growth by 1990.

A widening of the gap between the higher wages offered by the mining industry and by the local services sector would be unavoidable. This would aggravate the problems those on low or fixed incomes have in competing for goods, services, and housing.

The projected rapid growth would put temporary unavoidable financial pressures on local governments. Community governments would be affected more than counties, since they would receive the majority of the population increase.

The proposed actions would induce an increase in population that would require housing. Regional population would need a projected 24,390 dwelling units by 1990. Of these, a projected 3,134 would be a result of the proposed actions. Rock Springs, Green River, Evanston, and the Kemmerer/Diamondville area would need approximately 88% of the regional housing required throughout the period of 1990. Since all of this housing would not be immediately available, the incoming population would have to accept inferior quality housing.

The region would experience an unavoidable increase in demand for health services. There would not be enough physicians, dentists, and professional nurses to meet the demand, and the quality of health care would be lowered during the early, high-growth years.

There would be increased demands for social services and police and fire protection by the larger population. These impacts would lessen after local governments had time to respond to the demands.

Population growth would increase the size of communities in the region, reducing the small-town atmospheres. Pressures on community services and facilities would temporarily degrade the quality of life. Rock Springs, Green River, and Kemmerer/Diamondville would be most severely affected. These impacts would continue only until the region's growth stabilized after 1980 and communities were able to catch up with the demands. The impacts would reduce to insignificance once requirements for increased plant or personnel requirements were met; this would probably occur during the 1980 to 1985 period.

CHAPTER 6

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The ES region has established coal and trona mining and oil and gas industries. Projected coal development (including the five pending mining and reclamation plans under consideration) in response to national energy needs would increase production to 31.2 million tons from 16.0 million tons by 1990. Production could level off or conticue to increase beyond the 1990 projection, depending on market demands. There are ample coal reserves for several hundred years at the 1990 production figure. As reserves at individual mines are depleted, other mines could be developed and absorb the workers. At the time of production, a substantial acreage would be committed to mines and ancillary facilities and thus lost to other uses at any one time. Basically, the projected level of coal mining represents a long-term commitment--expansion of existing activity. There will be sharp short-term impacts (social and economic), but an adjustment is expected to occur after approximately 3 to 5 years.

Essentially, the proposed actions, approving mining plans which would allow the mining of 353 million tons of coal to help meet the nation's short-term energy needs and allow additional time to develop alternative energy needs, would result in short-term and long-term losses or alterations of natural resources and the human environment.

In the short-term there would be:

1. a reduction in air quality due to increases in fugitive dust and vehicular emissions;

2. a reduction in soil productivity on about 11,785 acres of soil surface;

3. a use of 5,040 acre-feet of water per year;

4. a cumulative loss of an estimated 9,333 animal unit months due to the removal of native vegetation on 15,917 acres;

5. a deterioration of fisheries habitat and water quality due to increased sedimentation;

6. an alteration of stream, spring, and seep flow on and adjacent to affected lands due to aquifer disruption, and a potential lowering of water quality due to the passage of ground water through spoil.

7. the direct loss of 15,917 acres of wildlife habitat and carrying capacity and an indirect loss or adverse affect on 71,626 acres of habitat and carrying capacity;

8. seasonal range losses as shown on Table R4-8D;

9. the loss of an estimated 112,400 small nongame birds, 8,200 sage grouse, 1,200 raptors, 13.5 million small nongame mammals, 1,370 antelope, 850 deer, 160 elk, 20 moose, and 125,000 reptiles and amphibians; and

10. the destruction of an estimated 301 nonrenewable cultural resource sites. The significance of this loss cannot be determined until the location and nature of these disturbances are known.

11. There would also be a reduction from Visual Resource Management Classes (VRM) II, III, and IV to Class V;

12. a lowering in the "primitive"quality of recreational experiences due to increased population;

13. impeded traffic movement due to increased numbers of trains and vehicles (contributing to human frustrations and anxieties);

14. about 3,497 new jobs in the region which would substantially raise the average regional income; and

15. a disruption of social order due to rapid population growth and subsequent changes in community structure.

Residual effects of mining on the long-term productivity would be:

1. the loss of vegetative productivity on about 1,100 acres occupied by housing and other permanent structures;

2. a reduction in soil productivity on a portion of 11,785 acres of soil surface.

3. the permanent loss of 5 raptor nesting sites (potential offspring loss of 15 birds per year);

4. a deterioration of fisheries habitat and water quality due to increased sedimentation;

5. an alternative of stream, spring, and seep flow on and adjacent to affected lands due to aquifer disruption, and a potential lowering of water quality due to the passage of ground water through spoil;

6. the loss of 139 known fossil vertebrate localities and impacts to an undetermined number of uninventoried exposed and unexposed fossil localities;

7. a gain in knowledge of paleontological resources due to surveys and exposure of resources which might never have been found without excavation;

8. the degradation of some VRM Class II, III, and IV areas to Classes IV and V until successful revegetation (the areas would then return to those classes which existed prior to mining);

9. a lowering of the "primitive"quality of recreational experience due to increased population;

10. the loss of approximately 84 million tons of unrecoverable coal which could possibly be salvaged with future mining methods;

11. improved public facilities in response to demands of an increased population; and

12. a mixing and integration of life styles as new types of people contribute to variety within community groups.

CHAPTER 7

ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTIONS SHOULD THEY BE IMPLEMENTED

Approximately 353 million tons of coal would be produced and consumed as a result of the proposed actions. An estimated 84 million additional tons of economically minable coal would be lost and unrecoverable due to current mining methods. An unknown quantity in the overburden and (or) interburden would be lost. This coal would be in seams too thin or of too low a quality to be of economic interest.

Energy, in the forms of petroleum products and electricity, would be expended to obtain coal and consumed by the increased population in the region.

Some materials used in manufacturing mining machinery and buildings would not be recycled and, thus, would be lost.

Renewable resources, air quality and visibility, would be reduced during the life of the projects (1978 to 2018). This change is not irreversible; however, the loss of clean, clear air during the life of the project would be irretrievable.

Existing soil associations on approximately 11,785 acres would be irretrievably lost.

Loss would include the destruction or disturbance of 139 known fossil vertebrate localities and impacts to an undetermined number of uninventoried exposed and unexposed fossil localities.

Soil and vegetative productivity would be lost on approximately 1,100 acres due to housing and other permanent structures.

An estimated 621 tons of available nitrogen and 372 tons of available phosphorous would be used in reclamation.

Forage (about 9,333 animal unit months) for livestock consumption would be lost.

Based upon 1976 nationwide figures, 12.63 injuries occurred for every million tons of coal mined in strip mining. In underground mining, 73.55 injuries occurred per million tons of coal mined. Fatalities per million tons of coal mined for strip mining were 0.06 and for underground mining were 0.39. In Wyoming, for all coal mining, 10.37 injuries occurred per million tons of coal mined of which 0.07 were fatalities.

Also, nationwide in 1976, 43,82 injuries occurred in strip mining per million man hours and 87.46 injuries occurred in underground mining per million man hours. Fatalities for strip mining were 0.22 per million man hours and for underground mining 0.45 per million man hours. In Wyoming, for all coal mining, 54.68 injuries occurred per million man hours of which 0.35 were fatalities.

By 1990, an additional 158 injuries would occur per year in coal mining as a result of the proposed actions. Also, one person per year could be expected to have lost his life in coal mining due to the proposed actions. Difference in mining methods and attention to safety precautions could induce departures from expected rates in the future.

Water consumption would be increased by 5,040 acre-feet per year. Also, ground water pumping from thick Tertiary and Cretaceous age sand and shale aquifers could cause subsidence.

Wildlife habitat, carrying capacity, and populations would be lost during mining on 15,917 acres as a direct result of mining and indirectly affected (area of influence) on 71,626 acres.

Specific seasonal range losses for the major game species are shown on Table R4-8D.

The loss of an estimated 112,400 small nongame birds, 8,200 sage grouse, 1,200 raptors, 13.5 million small nongame mammals, 1,370 antelope, 850 deer, 160 elk, 20 moose, and 125,000 reptiles and amphibians would occur. Total wildlife populations which would be lost are shown on Table R4-8A.

Visual resources would be altered, with classes III and IV being the highest attainable visual resource management classes after successful revegetation.

Cultural resources would be inadvertantly destroyed on an estimated 91 known sites.

There would be a lowering of the "primitive"quality of the recreational experiences which current exist throughout southwestern Wyoming. There would also be an overcrowding of recreational facilities.

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTIONS

This chapter describes potential impacts of four alternatives to the proposed actions: the No-Action Alternative, the Fish and Wildlife Mitigation Alternative, the Defer Federal Action Alternative, and the Socioeconomic Mitigation Alternative. Also, in order to identify impacts of production levels lower than and higher than the most probable level, two scenarios, low and high, are shown for comparison. Since the No-Action Alternative and the Low-Level Scenario use the same coal production and data, they are presented together as the No-Action Alternative and Low-Level Scenario. Only those resources which have significant or potentially significant impacts are analyzed in these alternatives.

Alternate sites for surface facilities, surface mining techniques, methods of coal transport, and rates of production are considered where appropriate, but no such modifications have been proposed or identified which would significantly reduce the adverse impacts of coal production from the environmental statement (ES) region.

Assumptions and guidelines used in developing this chapter are the same as those used in Chapter 1. Where data were unavailable, the team developed conversion factors by averaging data supplied in the proposed actions of Chapter 1. The conversion factors below were designed using the information provided in the four surface mines described in Chapter 1 and Table R1-2. Each calculation was rounded as appropriate to facilitate the reader's review.

1. Average acreage per year disturbed per million tons of coal mined equals 50 acres.
2. Average acreage disturbed for rights-of-way and mine facilities equals 200 acres per coal mine.
3. Average mine life is 26 years.
4. Employment per million tons of production per year is: construction—40 employees and operations—100 employees.
5. Market calculations in unit trains and compass direction: east—40% and west—60%.

The methodologies used to determine fugitive dust emissions emanating from the coal mines considered in the alternative scenarios, as well as meteorological data and modeling techniques, are equivalent to those presented in Chapter 4. Particulate emission rates, as well as the acres disturbed, used to determine the size of the area sources in the Environmental Research and Technology Air Quality model are presented in the discussion of the high-level scenario for the three existing leases without proposed mine plans and the three potential mining areas of interest. These parameters for all other mines evaluated herein are presented in Tables RB-2B, RB-2C, and RB-2D in Appendix B. The Rock Springs meteorological data were employed for all mines located in Sweetwater County; Fort Bridger meteorological data were used for all mines located within Lincoln and Uinta Counties.

NO-ACTION ALTERNATIVE AND LOW-LEVEL SCENARIO

The no-action alternative and low-level scenario includes a cumulative analysis of five existing mining operations and the development of two projected private mines, Reliance and Winton. These mines will have to comply with the requirements of the Initial Regulations (30 Code of Federal Regulations (CFR) 700) after 3 May 1978. The five existing mines will continue to operate under current plans on private, state, and federal coal reserves with no expansions. The two projected private mines are expected to be in full production by 1985.

The analysis developed in this section is a cumulative regional assessment of new impacts expected to occur through 1990 from the concurrent development of private coal and other resources (oil and gas, etc.). Impacts of the Reliance and Winton underground mines were not considered to be sufficiently significant in the regional analysis to warrant a separate detailed analysis and are considered as a part of the regional growth and development impacts. Table R8-1 provides detailed information on the existing and proposed private mines in southwestern Wyoming.

Air Quality

The cumulative total suspended particulate (TSP) impacts presented in this section have been computed by adding predicted mine-related suspended particulate (SP) concentrations to projected background concentrations. Total suspended particulate levels (mine plus background) characterize predicted ambient air quality, and total concentrations may be compared to Federal and Wyoming ambient air quality standards. The Chapter 4 and Chapter 8, Regional Technical Reports (Envrionmental Research and Technology (ERT) 1978a), on file at the Rock Springs District Office of the BLM, detail the parameters and techniques used to obtain the following results.

Best management practices were not necessarily included in the air quality impact analysis. Only those miti-

Table R8-1

LOW LEVEL OF DEVELOPMENT OF EXISTING AND PROJECTED
PRIVATE MINES IN SOUTHWESTERN WYOMING BY 1990

Map Reference	Names	Mining Method	Total Recoverable Reserves (MM Tons)	Annual Coal Production (MM Tons/Year) 1977	1980	1985	1990
	Existing mines						
A	South Block Mine	Surface	83	3.5	3.5	3.5	3.5
B	Skull Point Mine	Surface	27	1.2	1.2	1.2	1.2
C	Stanbury Mine	Underground	19	0.5	1.0	1.0	1.0
D	Rainbow-Columbine Mine	Underground	NA	0	0	0.3	0.3
E	Bridger Mine	Surface	210	5.3	7.5	7.5	7.5
	Subtotal			10.5	13.2	13.5	13.5
	Projected development of private coal						
F	Winton Mine	Underground	40	0	0	2.0	2.0
G	Reliance Mine	Underground	9	0	0	0.5	0.5
	Subtotal			0	0	2.5	2.5
Total				10.5	13.2	16.0	16.0

NA = Not Available

Table R8-1

LOW LEVEL OF DEVELOPMENT OF EXISTING AND PROJECTED
PRIVATE MINES IN SOUTHWESTERN WYOMING BY 1990
(Continued)

Map References	Names	TIME POINTS: Start Const.	TIME POINTS: Full Mine Operation	TIME POINTS: Mine Life (Years)	ACRES: Total Project Acres[1]	ACRES: Federal Coal Lease Acres	ACRES: Total Surface Acres to be Mined[2]	ACRES: Average Acres Disturbed Per Year[1, 2]
	Existing Mines							
A	South Block Mine	1963	1965	35	2,779	0	426	50
B	Skull Point Mine	1975	1977	20	746	3,201	0	21
C	Stanbury Mine	1975	1977	20	4,194	0	0	3
D	Rainbow-Columbine Mine (Now Closed)	1959	Closed	Unknown	4,965	0	0	0
E	Bridger Mine	1974	1978	30	20,600	8,436	4,826	160
	Subtotal				33,284	11,637	5,252	234
	Projected Development of Private Coal							
F	Winton Mine	1983	1985	20	11,558	0	0	2
G	Reliance Mine	1983	1985	17	8,934	0	0	2
	Subtotal				20,492	0	0	4
Total					53,776	11,637	5,252	238

[1]Includes public, state and private.
[2]Includes mine and on site haul roads.

Table R8-1

LOW LEVEL OF DEVELOPMENT OF EXISTING AND PROJECTED
PRIVATE MINES IN SOUTHWESTERN WYOMING BY 1990
(Continued)

Map Reference	Names	EMPLOYMENT 1980 Const.	1980 Perm.	1985 Const.	1985 Perm.	1990 Const.	1990 Perm.	Estimated Number and Direction of Market Unit Trains for the Years[1] 1980	1985	1990	Market Area
	Existing mines										
A	South Block Mine	0	535	0	535	0	535	0	0	0	Local Power Gen.
B	Skull Point Mine	0	100	0	100	0	100	0	0	0	Local Trona Plant
C	Stansbury Mine	0	240	0	240	0	240	0	0	0	MT, WA, CO, and NE
D	Rainbow-Columbine Mine	0	0	0	87	0	87	0	Unknown	Unknown	Local Use
E	Bridger Mine	0	260	0	260	0	260	0	0	0	
	Subtotal	0	1,135	0	1,222	0	1,222				
	Projected Development of Private Coal										
F	Winton Mine	0	0	0	125	0	125	0	---/200W	---/200W	ID, OR, and NV
G	Reliance Mine	0	0	0	270	0	270	0	50E/---	50E/---	NE and KS
	Subtotal	0	0	0	395	0	395	0	50E/200W	50E/200W	
Total		0	1,135	0	1,617	0	1,617	N/A	50E/200W	50E/200W	

[1]Assumes one unit train equals 100 cars, each train having a capacity of 10,000 tons of coal. Does not include return traffic.

N/A = Not Applicable
E = Eastbound
W = Westbound

gating measures discussed in the mining and reclamation plans on file with the Geological Survey (USGS) in December, 1977, were included in the modeling. In any event, the worst-case mine situation is discussed, and best management practices will produce fewer and less intense impacts.

Predicted Annual Average Cumulative Impacts on TSP Concentrations

The highest background concentrations are projected to be in the industrial and urban sectors of Sweetwater County for 1985 and 1990. Cumulative TSP levels in the vicinities of the trona patch and Jim Bridger Power Plant consist of simulated mine contributions of only 0.1 micrograms per cubic meter ($\mu g/m^3$) and background levels of 23 to 45 $\mu g/m^3$. Background also dominates the cumulative values near Rock Springs, where the two mines are projected to contribute 0.2 $\mu g/m^3$, and background contributes 28 to 38 $\mu g/m^3$ in 1985 and 25 to 35 $\mu g/m^3$ in 1990. Peak rural cumulative levels are predicted to occur near the mine sites. However, simulated mine concentrations are less than 1 $\mu g/m^3$, which result in cumulative levels ranging from 14 to 24 $\mu g/m^3$. Outside a 25-mile radius from the two projected mines, there is no simulated mine impact on TSP concentrations. Therefore, cumulative TSP levels in these areas are represented by background alone as shown on Map R8-1.

Cumulative TSP concentrations are predicted to be less than the Wyoming 60 $\mu g/m^3$ and Federal 75 $\mu g/m^3$ standards throughout the ES region. From the preceding discussion, it is evident that background levels heavily dominate simulated cumulative impacts associated with the low-level scenario.

Predicted 24-Hour Average Cumulative Impacts on TSP Concentrations

Maximum 24-hour average background concentrations are predicted to occur in the industrial and urban sectors of Sweetwater County. Cumulative TSP concentrations near the trona patch and Jim Bridger Power Plant are predicted to range from 61 to 226 $\mu g/m^3$ for 1985 and 1990, with mine-related contributions of only 1 $\mu g/m^3$. The upper background limit of 225 $\mu g/m^3$ alone is higher than the Wyoming standard of 150 $\mu g/m^3$. For the urban area of Rock Springs, cumulative TSP levels are projected to be 57 to 112 $\mu g/m^3$ in 1985 and 52 to 102 $\mu g/m^3$ in 1990. Simulated mine contributions account for only 2 $\mu g/m^3$ in both analysis years. Note that under the new Prevention of Significant Deterioration (PSD) regulations (43 CFR 118), these violations do not occur. In fact, the surface mines are well within the applicable National Ambient Air Quality Standards (NAAQS) and PSD regulations.

The highest cumulative rural concentrations of 49 $\mu g/m^3$ are predicted to occur in the vicinity of the two mines. Background dominates these levels since the simulated contribution from the mines is only 19 $\mu g/m^3$. Predicted mine-related concentrations outside the northcentral portion of Sweetwater County are less than 1 $\mu g/m^3$; therefore, cumulative impacts elsewhere are primarily attributable to background.

As indicated in the preceding discussions, simulated impacts attributable to the low-level scenario do not exceed the 24-hour average NAAQS. However, cumulative impacts attributable to background alone in the industrial areas of Sweetwater County are projected to be greater than the 150 $\mu g/m^3$ Wyoming standard. Elsewhere, the Wyoming standard is maintained.

Gaseous Pollutant Impacts

Cumulative impacts on gaseous pollutants (carbon monoxide (CO), hydrocarbon (HC), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) are similar to those associated with the proposed actions and, therefore, insignificant when compared to the standards. Refer to Chapter 4 for a more detailed discussion.

Indirect Air Quality Impacts

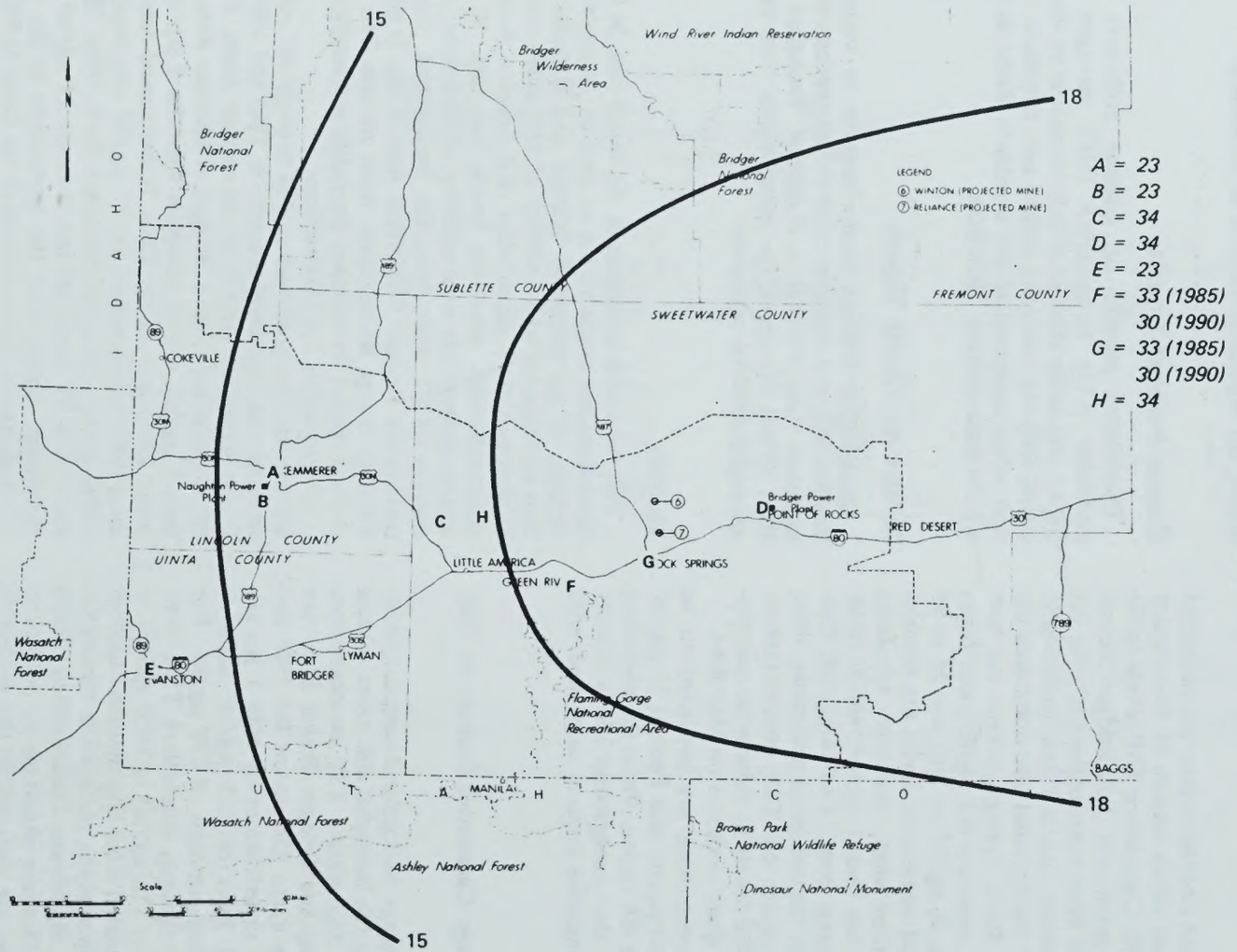
Quantitative indirect source impacts on variations in baseline SO_2 and nitrogen oxide (NO_x) concentrations are unknown (see Chapter 2, Regional Technical Report ERT 1978a). However, the contributions from the mines are expected to be negligible.

Visibility

For the low-level scenario, the worst-case 24-hour SP concentrations attain values as high as 19 $\mu g/m^3$ in the vicinity of the projected Winton and Reliance Mines. This corresponds to a visibility of 37.8 miles, assuming a background of 40 miles. Most of the region, however, is associated with simulated levels less than 10 $\mu g/m^3$, which corresponds to a visibility of 38.8 miles, or a reduction of 1.2 miles from the background. Concentrations in the Bridger Wilderness Area (Class I) and in the Flaming Gorge Recreational Area are less than 0.3 $\mu g/m^3$, and impact on visibility degradation is negligible.

All applicable PSD restrictions are met by the predicted annual average SP concentrations for the high-level scenario in 1985 and 1990 except in the immediate vicinity of the surface mines. Predicted SP levels in the Class I Bridger Wilderness Area are less than 1 $\mu g/m^3$, which complies with the 5 $\mu g/m^3$ increment. Elsewhere in the Class II designated areas, maximum SP concentrations of 11 $\mu g/m^3$ are predicted to occur in the vicinity of the Black Butte Mine. However, these peak SP levels are less than the 19 $\mu g/m^3$ Class II increment. Again, with the application of the 43 CFR 118 regulations, the violations of the Class II PSD increment in the near vicinity of the surface mines will not occur.

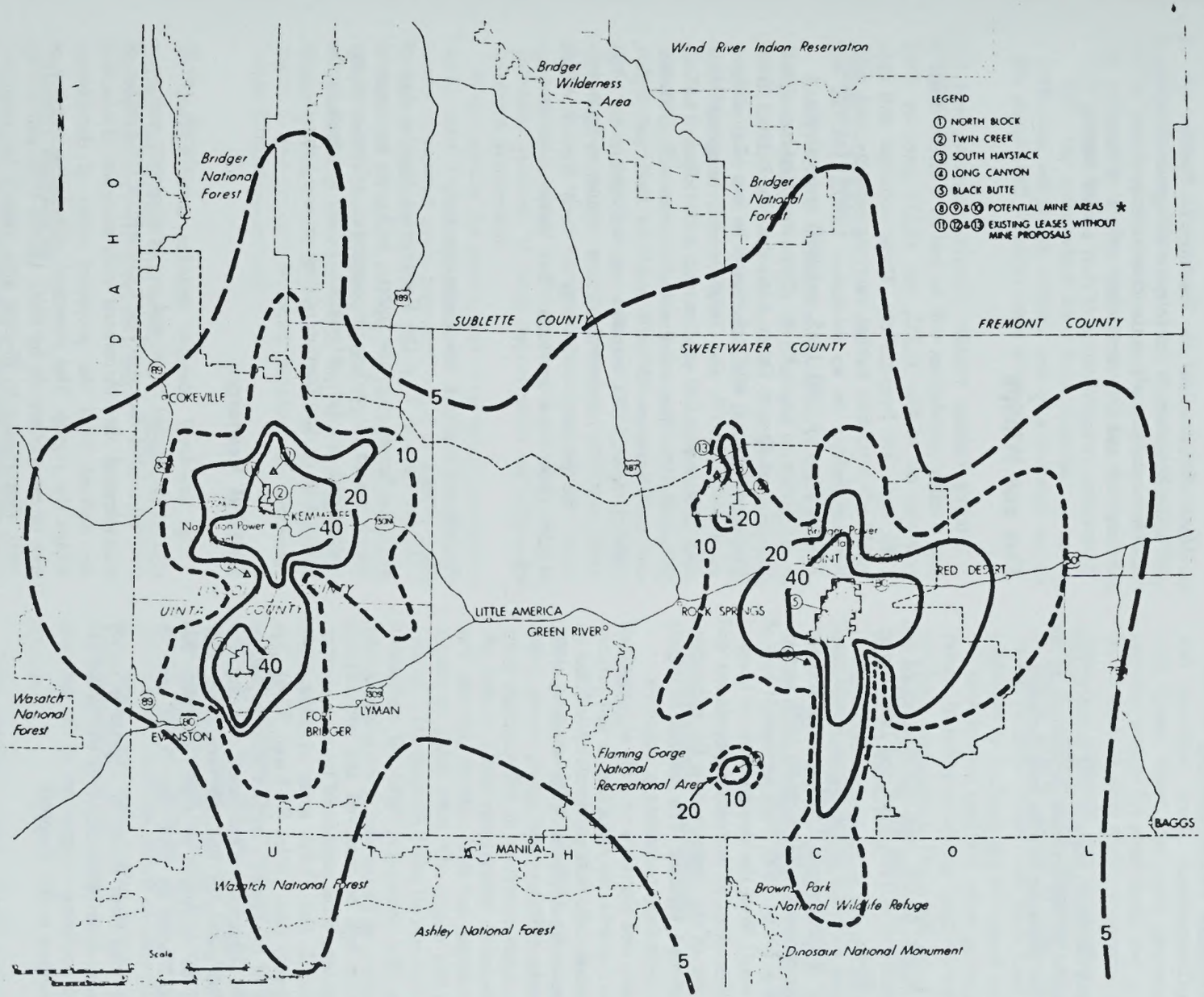
The Flaming Gorge Recreational Area, shown in Map R8-2, and the Fossil Butte National Monument located approximately 10 miles northwest of Kemmerer are currently designated Class II areas but may be reclassified to Class I. However, predicted SP concentrations in these



Map R8-1 .

LOW-LEVEL: CUMULATIVE 1985 AND 1990 ANNUAL AVERAGE TSP CONCENTRATIONS (ug/m^3)

Source: ERT 1978a



Map R8-2

LOW-LEVEL SCENARIO: CUMULATIVE 1985 AND 1990 PREDICTED 24-HOUR AVERAGE TSP CONCENTRATIONS ($\mu g/m^3$)

*Equivalent to "mine areas of interest."

Source: ERT 1978b.

areas are approximately 1 $\mu g/m^3$ in 1985 and 1990, well below the Class I 5 $\mu g/m^3$ increment.

Annual average SP concentrations of less than 1$\mu g/m^3$ in 1985 and 1990 are predicted to occur in the vicinity of the nonattainment (NA) trona patch, located 6 miles north of Green River. The predicted mine impact is less than 1% of the 260 $\mu g/m^3$ Federal standard.

Paleontology

Both adverse and beneficial impacts will occur to paleontological resources in approximate proportion to the level of regional development and the area disturbed.

Soils

An estimated 16,802, 33,352, and 49,235 acres of soil surface will be disturbed by 1980, 1985, and 1990, respectively (see Table R1-6).

Future population increases in the region would result in the removal of approximately 1,000 acres of soil surface by 1980, approximately 1,500 acres by 1985, and approximately 2,000 acres by 1990. This permanent loss of soil surface will result from the construction of housing and support facilities. Also, an increase in population will result in greater use of the region's soils for recreation, particularly by off-road vehicles. The amount of impact on soils that will result from recreation is unknown.

Major disturbance and alteration of soils as a result of mining will cause a short-term reduction in soil productivity on the affected soils. Soil productivity will be reduced on 4,967 acres by 1980, on 6,567 acres by 1985, and on 6,700 acres by 1990.

Vegetation

Terrestrial

Native vegetation will be removed and productivity lost for short- and long-term periods of time on approximately 16,802, 33,352, and 49,235 acres by 1980, 1985, and 1990, respectively (see Tables R1-6 and R4-6). Approximately 0.8% of the region's surface acreage will be disturbed by 1990. Additional disturbance of vegetation will be caused by increased outdoor recreation. Disturbed lands will be reclaimed at a rate of about 900 acres by 1980, 5,667 acres by 1985, and 19,640 acres by 1990.

The short- and long-term losses of vegetative cover and production from disturbance activities will affect numerous living and nonliving components of the environment (see other sections in this chapter).

Aquatic

Sufficient information is unavailable to determine what impact, if any, energy-related disturbance activities would have on algae and other aquatic vegetation present in seasonal drainages or perennial streams of the region.

Endangered and (or) Threatened Species

Under Section 7 of the Endangered Species Act of 1973, the Secretary of the Interior will grant no approval which would jeopardize the continued existence of any endangered and (or) threatened species or result in the destruction or modification of their critical habitat.

Fish and Wildlife

Wildlife habitat, wildlife carrying capacity, and fish and wildlife populations will be lost as a direct result of activities on 16,802, 33,352, and 49,235 acres by 1980, 1985, and 1990, respectively. These activities will indirectly affect wildlife habitat, carrying capacity, and wildlife populations on an estimated 76,600, 150,000, and 221,600 acres by 1980, 1985, and 1990, respectively.

As shown on Table R4-8C (Estimated Number of Individuals Lost Due to Other Activities Not Related to the Proposed Actions, 1990), there will be loss of an estimated 45,000, 230,000, and 340,000 small nongame birds; 550, 2,700, and 4,000 sage grouse; 2.23 million, 11.5 million, and 16 million small nongame mammals; 300, 900, and 1,400 antelope; 250, 800, and 1,300 deer; and 37,000, 184,000, and 271,000 reptiles and amphibians by 1980, 1985, and 1990, respectively. These population figures include the progeny (offspring) of each species which would have been produced had disturbance not occurred.

Endangered and (or) Threatened Species

Under Section 7 of the Endangered Species Act of 1973, the Secretary of the Interior will grant no approval which would jeopardize the continued existence of any endangered and (or) threatened species or result in the destruction or modification of their critical habitat.

Cultural Resources

The low-level scenario includes those cultural resources threatened by oil and gas development and other noncoal-related disturbances. Estimates of the number of archeological sites threatened with complete distruction are derived from the projected acres of disturbance within the region. The estimated cumulative number of sites threatened are: 56 by 1980, 146 by 1985, and 210 by 1990. Disturbance to historic sites cannot be quantified until the location of these disturbances can be clearly determined.

Recreational Resources

Increased recreational demand will occur in all activities because of population increases. For some activities, data were not available (Table R8-2). The increased use will lower the quality of recreation experience of the ES region.

As a result of increased use, there will be increased maintenance and clean-up costs. There will also be conflicts between local ranchers and the recreationists which would result in the ranchers restricting access across their private lands.

Since the areas which have been identified as having wilderness values are isolated and of a badlands nature, few people will travel to these areas.

Agriculture

Livestock Grazing

Energy-related activities will remove native vegetation from an estimated 16,802, 33,352, and 49,235 acres by 1980, 1985, and 1990, respectively. Forage for livestock will be lost due to these activities (animal unit month (AUM) data are unavailable).

The loss of AUMs due to these activities will be detrimental to the region's livestock industry but will not significantly affect production of livestock. Reclamation will be conducted on an estimated 39% (19,640 acres) of the acreage which will be disturbed by 1990 (49,235 acres or 0.8% of the region's surface acreage).

Additional people in the region will probably result in increased incidents of range improvement vandalism and livestock molestation.

Water needed for mining and other activities could in some cases deplete water supplies for livestock. Surplus water on deeded lands, however, could be sold by some livestock operators for extra income.

New and (or) improved road networks and utility lines could benefit some livestock operators.

Inflation and the competition for labor resulting from higher paying industrial jobs will also be detrimental impacts to the region's livestock industry (see Socioeconomic Conditions section).

Prime Farmland

Data are lacking with which to determine if energy-related activities will affect such lands.

Mineral Resources

The only significant impact to mineral resources under the no-action alternative will be the reduction of approximately 200 million tons of coal reserves by 1990. This figure includes approximately 30 million tons of coal which will be lost due to mining methods (both surface and underground).

Transportation Networks

Growth will contribute to increased travel on primary and secondary roads. Kemmerer/Diamondville, Evanston, Green River, and other communities that serve as regional centers for retail trade and service activities will be confronted with traffic congestion and parking problems. It is estimated that the number of vehicle registrations in southwestern Wyoming would increase from 52,500 in 1976 to 59,600 in 1980, 65,800 in 1985, and 69,700 in 1990. There will be a need to upgrade some highways to facilitate the increased use. Increased use of rail lines to haul coal and other goods may interfere with people traveling at critical points where overpasses have not been constructed. There will be an increased number of trains servicing the region by 1980, 1985, and 1990 as depicted on Table R8-3.

The increased population growth of the area will mean there will be more people recreating and traveling in the area. There will be conflicts with landowners which would prompt the closing of roads across private lands.

Socioeconomic Conditions

Population

Additional development of coal, oil, gas, uranium, trona, and phosphate resources; the expansion of two existing power plants; and certain major public works projects should result in increased employment throughout the region. These employment increases, along with natural growth, should cause the population to increase as shown on Table R8-4. The region will grow at an annual rate of 3.1% through 1980; its rate will steadily decrease thereafter. By 1990, population will stabilize at 76,654 (the annual growth rate would be a minimal 1.2%).

Employment

Total employment in the region will reach 30,834 by 1980, 34,295 by 1985, and 36,313 by 1990. These will be significant increases over the 1977 figure of 28,118 jobs. The unemployment rate will be temporarily reduced between 1980 and 1985, but it will not be significantly or permanently reduced. While specific data are not available, more jobs with higher salaries will become and remain available in the region.

Income

Total personal earned income will increase to $416.5 million by 1980, $535.8 million by 1985, and $644.9 million in 1990. These are respective increases of 21.5%, 56.3%, and 88.1% over the 1977 figure of $342.8 million.

Table R8-2

IMPACTS OF LOW-LEVEL SCENARIO IN VISITOR DAYS DEMAND FOR SOUTHWEST WYOMING

	1977	1980 Low Level	1985 Low Level	1990 Low Level
Fishing	250,300	278,500	313,100	335,500
General[1]	224,700	273,000	312,700	339,300
Hunting	79,100	85,900	94,300	99,400
Off-raod vehicles[2]	9,800	10,700	11,800	12,500
Sightseeing	76,800	84,200	95,400	102,600
Urban	154,500	178,100	215,100	239,300
Water sports	115,500	130,900	153,600	168,800
Winter sports	31,200	36,600	46,200	52,000

Note: Visitor Days consists of 12 hours.

[1]General includes camping, picnicking, etc.
[2]Estimate by ES Team Outdoor Recreation Planner.

Table R8-3

ESTIMATED FUTURE RAILROAD TRAFFIC WITH THE NO-ACTION ALTERNATIVE IN SOUTHWEST WYOMING

Segment	Estimated Capacity[1] (trains per day)	Current Traffic[1,2] (trians per day)	1980 Traffic[3,4] (trains per day)	1980 % Capacity	1985 Traffic[3,4] (trains per day)	1985 % Capacity	1990 Traffic[3,4] (trains per day)	1990 % Capacity
Kansas City to Topeka	70-80	44	48	60	56	70	65	81
Topeka to Gibbon	70-80	22	24	30	28	35	32	40
Council Bluffs to Gibbon	55-60	34	37	62	43	72	50	83
Gibbon to North Platte	70-80	53	58	73	67	84	78	98
North Platte to Cheyenne	70-80	47	51	64	60	75	69	86
Cheyenne to Hanna	70-80	51	56	70	65	81	75	94
Hanna to Rawlins	70-80	45	49	61	57	71	66	83
Rawlins to Green River	70-80	44	48	60	56	70	65	81
Green River to Granger	70-80	40	44	55	51	64	59	74
Granger to Kemmerer	25-30	13	14	47	16	53	19	63
Kemmerer to McCammon	25-30	13	14	47	16	53	19	63

Table R8-3

ESTIMATED FUTURE RAILROAD TRAFFIC WITH THE NO-ACTION ALTERNATIVE IN SOUTHWEST WYOMING
(Continued)

Segment	Estimated Capacity[1] (trains per day)	Current Traffic[1,2] (trains per day)	1980 Traffic[3,4] (trains per day)	1980 % Capacity	1985 Traffic[3,4] (trains per day)	1985 % Capacity	1990 Traffic[3,4] (trains per day)	1990 % Capacity
McCammon to Pocatello	25-30	13	14	47	16	53	19	63
Granger to Ogden	55-60	32	35	58	41	68	47	78

[1]Union Pacific Railroad Company 1978.
[2]Through freight only.
[3]Abt Associates 1978.
[4]Estimates by ES team.

Table R8-4

NO ACTION ALTERNATIVE - PROJECTED POPULATION: SOUTHWESTERN WYOMING ES REGION

	1977 Estimated Population	1980 Population Projection	1980 Impact of No Action Alternative	1985 Population Projection	1985 Impact of No Action Alternative	1990 Population Projection	1990 Impact of No Action Alternative
Sweetwater County[1]	41,263	45,320	4,057	52,951	11,688	57,286	16,023
Rock Springs	25,996	28,552	2,556	33,359	7,363	36,090	10,094
Green River	12,502	13,732	1,230	16,044	3,542	17,358	4,856
Balance of county	2,765	3,036	271	3,548	783	3,838	1,073
Lincoln County[1]	7,132	7,799	667	7,120	- 12	7,233	101
Kemmerer/Diamondville	3,655	3,996	341	3,648	- 7	3,706	51
Balance of county	3,477	3,803	326	3,472	- 5	3,527	50
Uinta County	11,521	12,381	860	12,214	693	12,135	614
Evanston	5,918	6,360	442	6,274	356	6,234	316
Lyman	2,392	2,571	179	2,536	144	2,520	128
Mountain View	677	728	51	718	41	713	36
Balance of county	2,534	2,722	188	2,686	152	2,668	134
Regional Totals	59,916	65,500	5,584	72,285	12,369	76,654	16,738

Source: Abt Associates 1978.

[1]That portion of the county within the ES region.

These significant increases will be attributed to a larger population with a larger percent of it earning the higher wages offered by the mining industry. Per capita income will also rise significantly in all three counties (30% to 50%).

Infrastructure

Private Sector. Retail sales will increase by $45.8 million by 1980, $137.9 million by 1985, and $253.1 million by 1990. The 1990 value ($415.7 million) will be significantly (156%) greater than the $162.6 million figure of 1977.

Housing. Housing requirements will be 2,123 units greater by 1980, 5,588 greater by 1985, and 7,452 greater by 1990 than the 1977 figure of 14,105 units. The significantly higher demand will cause the price of homes to increase and shortages to occur. Shortages will force new residents to accept inferior housing and make greater use of mobile homes.

Education. School enrollment will increase by 1,329 students by 1980, 2,756 by 1985, and 3,658 by 1990 over the 1977 figure of 11,390. By 1980, 58 classrooms will be needed to support the increased enrollment. By 1985, 123 classrooms will be needed; 163 will be needed in 1990.

Health Care. Requirements for physicians and dentists will increase from 40 in 1977 to 43 in 1980, 48 in 1985, and 51 in 1990. The increased population will cause moderate pressures on all health care facilities.

Law Enforcement. Personnel requirements will be nearly 39% greater by 1990. The incidence of crime will be expected to increase along with the increase of population.

Fire Protection. Regional fire protection personnel requirements will increase by over 20% by 1990. Increases will be directly related to population and community size increases.

Sewer and Water Systems. Data indicate that some communities will experience increased needs that will require expansion or replacement of their systems. This could be a significant impact if funds are not made available to the affected communities.

HIGH-LEVEL SCENARIO

The high-level scenario includes a cumulative analysis of the five proposed mines requiring federal action, the five existing mining operations, the projected development of two private mines, the possible development of five existing leases currently without mine proposals, the possible development of seven areas of interest which include preference right lease application areas), and the possible development of one competitive coal lease (bypass). The high-level scenario includes all of those actions which could develop as a result of federal approvals. Impacts from these actions are analyzed cumulatively as one segment of the total impacts, identified as areas of interest, which may be expected to occur regionally through natural growth and other resource development.

Best management practices were not necessarily included in the air quality impact analysis. Only those mitigating measures discussed in the mining and reclamation plans on file with the Geological Survey (USGS) in December, 1977, were included in the modeling. In any event, the worst-case mine situation is discussed, and best management practices will produce fewer and less intense impacts.

The proposed actions, the existing mines, and the projected development of two private mines have been previously identified. The five existing leases without mine proposals are shown in Table R8-5, their locations are shown on Map 1 in Appendix A. The seven areas of interest which include preference right lease application areas containing approximately 14,000 acres are shown on Map 1 in Appendix A. The one competitive coal lease application (bypass) containing 165 acres is shown on Map 1 in Appendix A. The seven areas of interest and the one competitive lease application are included only to indicate areas of interest for foreseeable future development. No leasing actions are planned at this time. Table R8-6 provides detailed information pertaining to all coal mining which would be present in the high-level scenario.

Air Quality

Model Predictions of Annual Average Impact on Suspended Particulates (SP) Concentrations for 1985 and 1990

The 1980 impacts are the same as those presented in Chapter 4 because no projected activity is expected by 1980. The mines included in this scenario include the five proposed action mines, the three existing leases without proposed mine plans, and three mining areas of interest. See Table R8-7 for the estimated total particulate emissions per year (not necessarily best management practice emissions) and see Tables R8-5 and R8-6 for other pertinent information for the six projected mines. Except for Black Butte and Twin Creek, the particulate emission rates for each proposed and projected mine varies insignificantly from 1985 to 1990; therefore, the maps depicting SP impacts for both analysis years are very similar. Consequently, a discussion of the model predictions for annual average SP concentrations applies to both years (see Map R8-2).

Regionally, predicted SP levels attributable to the mining operations vary from 1 to 11 $\mu g/m^3$ in 1985 and 1 to 9 $\mu g/m^3$ in 1990. Since the sum of estimated particulate emission rates from all mines in the ES region is highest in 1985, it follows that 1985 predicted impacts are also greatest. The highest concentrations occur close to the actual mine sites, and the isopleths depicting such levels are skewed to the east and northeast. This type of distribution is attributable to the predominant frequency of west and southwesterly winds as recorded at the Fort Bridger and Rock Springs meteorological stations. The highest concentrations of approximately 11 $\mu g/m^3$ in 1985 and 9 $\mu g/m^3$ in 1990 are predicted to occur within

Table R8-5

EXISTING LEASES WITHOUT MINE PROPOSALS

Map Reference Number[1]	Company Name	Lease Serial Number and Date	Acres
6	Kemmerer Coal Company	W-075206 (January 2, 1959)	1,247
7	FMC Corporation	W-061421 (March 1, 1963)	1,280
7	FMC Corporation	W-061422 (March 3, 1963)	1,921
8	Peabody Coal Company	W-03438 (March 1, 1970)	640
8	Peabody Coal Company	W-0220486 (April 1, 1976)	1,340
Total			6,928

[1]Map 1 in Appendix A.

Table R8-6

HIGH LEVEL OF DEVELOPMENT OF EXISTING, PROPOSED,
AND PROJECTED MINES IN SOUTHWESTERN WYOMING BY 1990

Map 1 Appendix A Reference	Names	Mining Method[1]	Total Recoverable Reserves	Annual Coal Production (MM Tons/Year) 1977	1980	1985	1990
	Proposed actions, 5 mines						
1	North Block Mine	Surface	54	0	0	1.4	1.4
2	Twin Creek Mine	Surface	40	0	2.5	2.5	2.5
3	South Haystack Mine	Surface	54	0	1.5	3.0	3.0
4	Long Canyon Mine	Underground	63	0	0.5	2.0	2.0
5	Black Butte Mine	Surface	146	0	6.3	6.3	6.3
	Subtotal			0	10.8	15.2	15.2
	Existing mines						
A	South Block Mine	Surface	NA	3.5	3.5	3.5	3.5
B	Skull Point Mine	Surface	NA	1.2	1.2	1.2	1.2
C	Stansbury Mine	Underground	NA	0.5	1.0	1.0	1.0
D	Rainbow-Columbine Mine	Underground	NA	0	0	0.3	0.3
E	Bridger Mine	Surface	NA	5.3	7.5	7.5	7.5
	Subtotal			10.5	13.2	13.5	13.5
	Projected development of private coal						
F	Winton Mine	Underground	40	0	0	2.0	2.0
G	Reliance Mine	Underground	9	0	0	0.5	0.5
	Subtotal			0	0	2.5	2.5
6-8	Projected development of existing leases without mine proposals	Combination	Unknown	0	0	1.9	1.9
9-11	Projected development of preference right lease applications	Surface	Unknown	0	0	2.5	2.5
12	Competitive coal lease (bypass)[1]		1.8	0	---	---	---
Total				10.5	24.0	35.6	35.6

[1] Includes public, state, and private.

Table R8-6

HIGH LEVEL OF DEVELOPMENT OF EXISTING PROPOSED, AND PROJECTED PRIVATE MINES IN SOUTHWESTERN WYOMING BY 1990
(Continued)

Map 1 Appendix A Reference	Names	EMPLOYMENT 1980 Const.	1980 Perm.	1985 Const.	1985 Perm.	1990 Const.	1990 Perm.	Estimated Number and Direction of Market Unit Trains for the Years[4] 1980	1985	1990	Market Area
	Proposed actions, 5 mines										
1	North Block Mine	50	0	0	200	0	200	N/A	N/A	N/A	Local power gen.
2	Twin Creek Mine	100	300	0	300	0	300	100E/150W	100E/150W	100E/150W	NV, ID, & TX
3	South Haystack Mine	180	130	0	260	0	260	---/150W	---/300W	---/300W	NV & Pacific NW
4	Long Canyon Mine	100	125	0	400	0	400	25E/ 25W	100E/100W	100E/100W	E. Coast & Pac. NW
5	Black Butte Mine	150	221	0	320	0	320	330E/300W	330E/300W	330E/300W	Illinois & Idaho
	Subtotal	580	776	0	1,480	0	1,480				
	Existing mines										
A	South Block Mine	0	535	0	535	0	535	N/A	N/A	N/A	Local power gen.
B	Skull Point Mine	0	100	0	100	0	100	N/A	N/A	N/A	Local trona plant
C	Stansbury Mine	0	240	0	240	0	240	50W	<50W	<50W	MT, WA, CO, & NV
D	Rainbow-Columbine Mine	0	0	0	87	0	87	0	0	0	Local use
E	Bridger Mine	0	260	0	260	0	260	N/A	N/A	N/A	Local power gen.
	Subtotal	0	1,135	0	1,222	0	1,222	50W	<50W	<50W	
	Projected development of private coal										
F	Winton Mine	0	0	0	270	0	270	None	---/200W	---/200W	ID, OR, & NV
G	Reliance Mine	0	0	0	125	0	125	None	50E/---	50E/---	NE & KS
	Subtotal	0	0	0	395	0	395	0	50E/200W	50E/200W	
6-8	Projected development of existing leases without mine proposals	0	0	0	250	0	250	0	57E/133W	57E/200W	Midwest & Pacific NW
9-11	Projected development of preference right lease applications	0	0	0	325	0	325	0	75E/175W	75E/175W	Midwest & Pacific NW
12	Competitive coal lease (Bypass)	0	0	0				N/A	N/A	N/A	Local power Gen.
Total		580	1,911	0	3,672	0	3,672	455E/675W	580E/1100W	580E/1100W	

[4]Assumes one unit train equals 100 cars, each train having a capacity of 10,000 tons of coal. Does not include return traffic.

E = Eastbound
W = Westbound

Table R8-6

HIGH LEVEL OF DEVELOPMENT OF EXISTING PROPOSED,
AND PROJECTED PRIVATE MINES IN SOUTHWESTERN WYOMING BY 1990
(Continued)

Source	Coal Production (Million Tons/Year)				Average Mine Acres Disturbed Per Year				Total Acres Disturbed	Mine Life	Permanent Employment			Unit Trains Per Year East/West		
	1977	1980	1985	1990	1977	1980	1985	1990	R/W & Facilities	(Years)	1980	1985	1990	1980	1985	1990
Existing federal leases w/o mining and reclamation plans	0	0	1.9	1.9	0	0	100	100	232	20	0	250	250	0/0	57/133	57/133
Areas of interest (includes preference right lease applications)		0	2.5	2.5	0	0	130	130	305	20	0	325	325	0/0	75/150	75/150
Competitive coal lease application (bypass)[1]	0	0	0	0	0	5	5	0	N/A	N/A	N/A	N/A	N/A	Local Power Generation		
Proposed actións (5 new mines)	0	10.8	15.2	15.2	0	792	792	792	1843	---	776	1480	1480	455/625	530/850	530/850
Subtotal	0	10.8	19.6	19.6	0	797	1027	1022	2390	---	776	2055	2055	455/625	662/1133	662/1133
Cumulative data from existing and projected private coal mines (Table R1-2)	10.5	13.2	16.0	16.0	234	234	238	238	NA	---	1135	1617	1617	None	50/200	50/200
Cumulative Total	10.5	24.0	35.6	35.6	234	1031	1265	1260	---	---	1911	3672	3672	455/625	712/1333	712/1333

[1]Would be part of existing coal mine (no new employees or increase in coal production).

N/A = Not Applicable
NA = Not Available

Table R8-6

HIGH LEVEL OF DEVELOPMENT OF EXISTING, PROPOSED,
AND PROJECTED MINES IN SOUTHWESTERN WYOMING BY 1990
(Continued)

Map 1 Appendix A Reference	Names	TIME POINTS			ACRES			
		Start Const.	Full Mine Operation	Mine Life (Years)	Total Project Acres	Federal Lease Acres	Total Surface Acres to be Mined[1, 2]	Average Acres Disturbed Per Year[1, 2]
	Proposed actions, 5 mines							
1	North Block Mine	1980	1983	35	2,473	2,153	1,711	69
2	Twin Creek Mine	1978	1980	16	2,841	835	733	107
3	South Haystack Mine	1978	1981	22	8,080	3,010	1,041	94
4	Long Canyon Mine	1978	1981	33	31,360	14,360	None	13
5	Black Butte Mine	1978	1980	25	36,600	11,630	10,560	509
	Subtotal				81,354	32,068	14,045	792
	Existing mines							
A	South Block Mine	1963	1965	35	2,779	0	1,750	50
B	Skull Point Mine	1974	1977	20	746	3,201	426	21
C	Stansbury Mine	1975	1978	20	4,194	0	0	3
D	Rainbow-Columbine Mine	1959	Closed	Unknown	4,965	0	0	0
E	Bridger Mine	1974	1978	30	20,600	8,436	4,826	160
	Subtotal				33,284	11,637	7,002	234
	Projected development of private coal							
F	Winton Mine	1983	1985	20	11,558	0	0	2
G	Reliance Mine	1983	1985	17	8,934	0	0	2
	Subtotal				20,492	0	0	4
6-8	Projected development of existing leases without mine plans	1983	1985	20	Unknown	6,928	2,000	100
9-11	Projected development of preference right lease applications	1983	1985	20	Unknown	14,109	2,600	130
12	Competitive coal lease (Bypass)	N/A	N/A	N/A		165	40	5
Total							25,687	1,264

[1]Includes mine and on site haul roads.
[2]Federal lease will not be mined before 1986.

N/A = Not Applicable

Table R8-7

PARTICULATE EMISSION RATES BASED ON TOTAL COAL PRODUCTION
FOR 1985 AND 1990

Projected Mines Map Reference Number (MRN)[1]	Emission Rate (tons per year)
8	83
9	79
10	225
11	56
12	147
13	91

[1]Refers to mine numbers indicated on Map R8-2. Numbers 8 to 10 correspond to the three mine "areas of interest" (preference right lease applications) and MRN-11 through MRN-13 correspond to the three existing leases without mine proposals. Throughout this report, these six mines will be referred to as MRN-8 through MRN-13.

approximately 3 miles northeast of the Black Butte Mine. Concentrations resulting from emissions at the Black Butte Mine alone comprise more than 95% of these maximum SP levels. Contributions from the Black Butte Mine to predicted levels of 3 to 11 $\mu g/m^3$ in 1985 and 3 to 9 $\mu g/m^3$ in 1990 range from 85% to 95% for both analysis years. Black Butte's highest contributions occur in the vicinity of the mine and decrease with distance away from the mine. Subregional maps depicting concentration isopleths close to the mine sites are presented in the Chapter 8, Regional Technical Report (ERT 1978a) on file at the Rock Springs District Office of the BLM.

The second highest subregional concentrations of 5 to 7 $\mu g/m^3$ are predicted to occur about the North Block and Twin Creek Mines. The Twin Creek Mine accounts for 82% of these simulated SP levels located due east of Twin Creek, and the North Block Mine accounts for 16%. The remaining 2% is attributable to the existing lease mines corresponding to MRN-11 and MRN-12 and the South Haystack Mine. Due east of North Block, the Twin Creek and North Block Mines comprise approximately 54% and 44%, respectively, of the 5 to 7 $\mu g/m^3$ simulated SP concentrations. The remaining 2% is again attributable to existing lease mines corresponding to MRN-11 and MRN-12 and the South Haystack Mine. The Twin Creek Mine dominates predicted SP levels in this subregion, since its emission rates for 1985 and 1990 are about three times higher than those of North Block.

Model Predictions of 24-Hour Average Impact on SP Concentrations for 1985 and 1990

Predicted regional SP impact from the high level of mining development alone differs very little from the levels simulated for the most probable level of mining development discussed in Chapter 4 (see Map R4-2E), because the emissions of the projected mines are only about 7% of the proposed action mines in 1985 and 1990. However, a complete analysis of the 24-hour average impacts has been done (Chapter 8, Regional Technical Report, ERT 1978a) and is available at the Rock Springs District Office of the BLM.

Regionally, simulated SP levels range from 5 to 120 $\mu g/m^3$, although somewhat higher concentrations are predicted to occur within 2 miles south of the proposed Twin Creek Mine. In the eastern portion of the ES region, estimated emissions emanating from the Black Butte Mine dominate predicted impact. Although several underground mines in this area are operational in 1985, the sum of their emission rates is less than 15% of the Black Butte Mine emission rate. The other mines in this area do influence concentrations predicted very close (within 3 to 5 miles) to each individual mine, but their concentration elsewhere is significant. Predicted concentrations in the Long Canyon subregion (including the two smaller underground mines) are low, with maximum levels of approximately 20 $\mu g/m^3$. An east-southeast wind direction dispersing emissions from the Black Butte Mine accounts for simulated levels of 20 to 40 $\mu g/m^3$ approximately 9 miles southeast of Long Canyon. Peak SP levels of 20 $\mu g/m^3$ are predicted to occur about the Long Canyon Mine attributable mostly to Long Canyon emissions; the other mines in this subregion have little or no effect on these predicted levels. Peak SP levels of approximately 120 $\mu g/m^3$ are predicted to occur about 2 miles north-northeast of the mine. Such concentrations are associated with a south-southwest wind direction. Elsewhere within the Black Butte subregion, concentrations are generally determined from the dispersion of estimated emissions from the Black Butte Mine alone.

A significant impact could result from north and south wind flow in the western portion of the ES region. Due to the relative locations of North Block, Twin Creek, South Haystack, and the two existing lease mines, both northerly and southerly winds result in the interaction of pollutants dispersing from all three surface mines. Such interaction is seen to affect simulated SP concentrations approximately 60 miles north and south of Kemmerer. Interaction between the South Haystack Mine and the North Block/Twin Creek mining subregion is small or nonexistent under easterly or westerly wind flow. In general, predicted levels east or west of South Haystack (within about 40 miles) are a result of fugitive dust emissions dispersing from the South Haystack Mine. Similarly, predicted levels near east or west of North Block and Twin Creek are a function of emissions emanating from these two mines. However, in 1985, emissions from the Twin Creek Mine are three times the estimated emissions from North Block; therefore, Twin Creek has greater influence in this subregion. Predicted concentrations in the North Block/Twin Creek subregion are higher than anywhere else in the ES region; the maximum predicted concentration is 323 $\mu g/m^3$ at an individual receptor located less than 2 miles south of Twin Creek. Such high impact results from a northerly wind flow. With application of the 43 CFR 118 regulations, it is unlikely that the violation discussed above would occur. However, without modeling it is not possible to say for certain.

Peak simulated levels of approximately 80 $\mu g/m^3$ occur in a small region south of the South Haystack Mine. Such levels, for the most part, are attributable to emissions emanating from South Haystack influenced by a north wind. The contribution from North Block, Twin Creek, and existing lease mines is minimal so close to South Haystack. However, the interaction phenomenon induced by north wind flow is evident further downwind. Otherwise the South Haystack Mine is the sole source of predicted levels within about 40 miles east or west of the mine site. Peak SP concentrations of 25 $\mu g/m^3$ are simulated for the mine area of interest denoted MRN-10; these levels are generally attributable to emissions emanating from the MRN-10 mine.

Mining areas of interest are existing lease mines corresponding to MRN-8 through MRN-13 have an insignificant contribution to 24-hour average concentrations on a regional scale due to their low emission rates. Therefore, regionally predicted SP concentrations for the high-level scenario hardly differ from the levels simulated for the most probable level of mining development discussed in Chapter 4.

For PSD increments, simulated concentrations in the Bridger Wilderness Area are less than 2 $\mu g/m^3$, which

does not interfere with the 10 $\mu g/m^3$ Class I increment. The remaining portion of southwestern Wyoming is designated Class II. The 37 $\mu g/m^3$ allowable PSD increment is exceeded in the vicinity of all the mine sites except that of Long Canyon, which is an underground mine. Note that under the new PSD regulations (43 CFR 118), these violations do not occur. In fact, the surface mines are well within the applicable NAAQS and PSD regulations.

At the present time, both the Flaming Gorge National Recreation Area and Fossil Butte National Monument are Class II regions but have the potential to be redesignated to Class I. Predicted worst-case 24hour average concentrations at Flaming Gorge are approximately 5 $\mu g/m^3$, less than the 10 $\mu g/m^3$ Class I increment. However, at the Fossil Butte National Monument, simulated SP levels are on the order of 20 $\mu g/m^3$, which exceeds the Class I increment but does not exceed the allowable Class II increment of 37 $\mu g/m^3$. Again with the application of the 43 CFR 118 regulations, the violations of the Class I increment will not occur.

The area located 6 miles north of Green River is designated an NA area. Simulated SP impact for this region is approximately 7 $\mu g/m^3$, which is less than 3% of the 260 $\mu g/m^3$ federal standard.

Gaseous Pollutants

Maximum predicted concentrations of CO ranged between 0.02% and 0.44% of the 40,000 $\mu g/m^3$ standard. Maximum predicted HC concentrations ranged between 0.88% and 3.44% of the 3-hour 160 $\mu g/m^3$ standard. Maximum predicted NO_2 concentrations ranged between 0.60% and 3.0% of the standards. Maximum predicted concentrations of SO_2 ranged between 0.02% and 0.33% of the standards. (Air quality standards for SO_2 and NO_2 are predicted in Chapter 4.)

The values represent predictions at less than one-half mile from the mines. Predictions were significantly less at further distances from the mines. Assuming similar vehicle activity for all western coal mines, the regional cumulative impact of vehicle emissions on ambient concentrations of gaseous pollutants would be minimal and insignificant compared to their respective standards.

Cumulative Impacts on Air Quality

This section presents a discussion of cumulative impacts on TSP levels in the ES region, i.e., the summation of predicted SP concentrations attributable to the mines discussed in the previous sections in combination with Winton and Reliance and projected background concentrations. These simulated 1985 and 1990 annual and 24-hour average cumulative TSP impacts are presented in Maps R8-3 through R8-6, respectively.

Model Predictions of Annual Average Cumulative Impacts on TSP Concentrations. The highest background levels are projected to occur within the industrial and urban areas of Sweetwater County. When combined with simulated mine concentrations, cumulative levels for 1985 and 1990 are predicted to range from 24 to 46 $\mu g/m^3$ in the vicinity of the Jim Bridger Power Plant and the trona patch; predicted mine contributions to these levels are approximately 1 $\mu g/m^3$. Cumulative TSP concentrations in the vicinity of Rock Springs are predicted to range from 29 to 39 $\mu g/m^3$ in 1985 and 26 to 36 $\mu g/m^3$ in 1990. Again, simulated mine contributions to these totals are approximately 1 $\mu g/m^3$. In the proximity of Kemmerer, the mines are predicted to contribute 7 $\mu g/m^3$ and 6 $\mu g/m^3$ to ambient TSP levels in 1985 and 1990, respectively. When combined with background, cumulative TSP levels range from 25 to 35 $\mu g/m^3$ in 1985 and 24 to 34 $\mu g/m^3$ in 1990. Background alone accounts for 80% of such predicted levels. Close to the Black Butte Mine where simulated mine TSP levels are the highest, cumulative concentrations range from 24 to 34 $\mu g/m^3$ in 1985 and 22 to 32 $\mu g/m^3$ in 1990. Background alone accounts for more than 50% of these levels; the remainder is primarily attributable to Black Butte. Within approximately 6 miles east of the North Block and Twin Creek Mines, maximum predicted cumulative levels range from 17 to 27 $\mu g/m^3$ in both analysis years. Background accounts for more than 60% of this total; the North Block and Twin Creek Mines dominate the mine contributions.

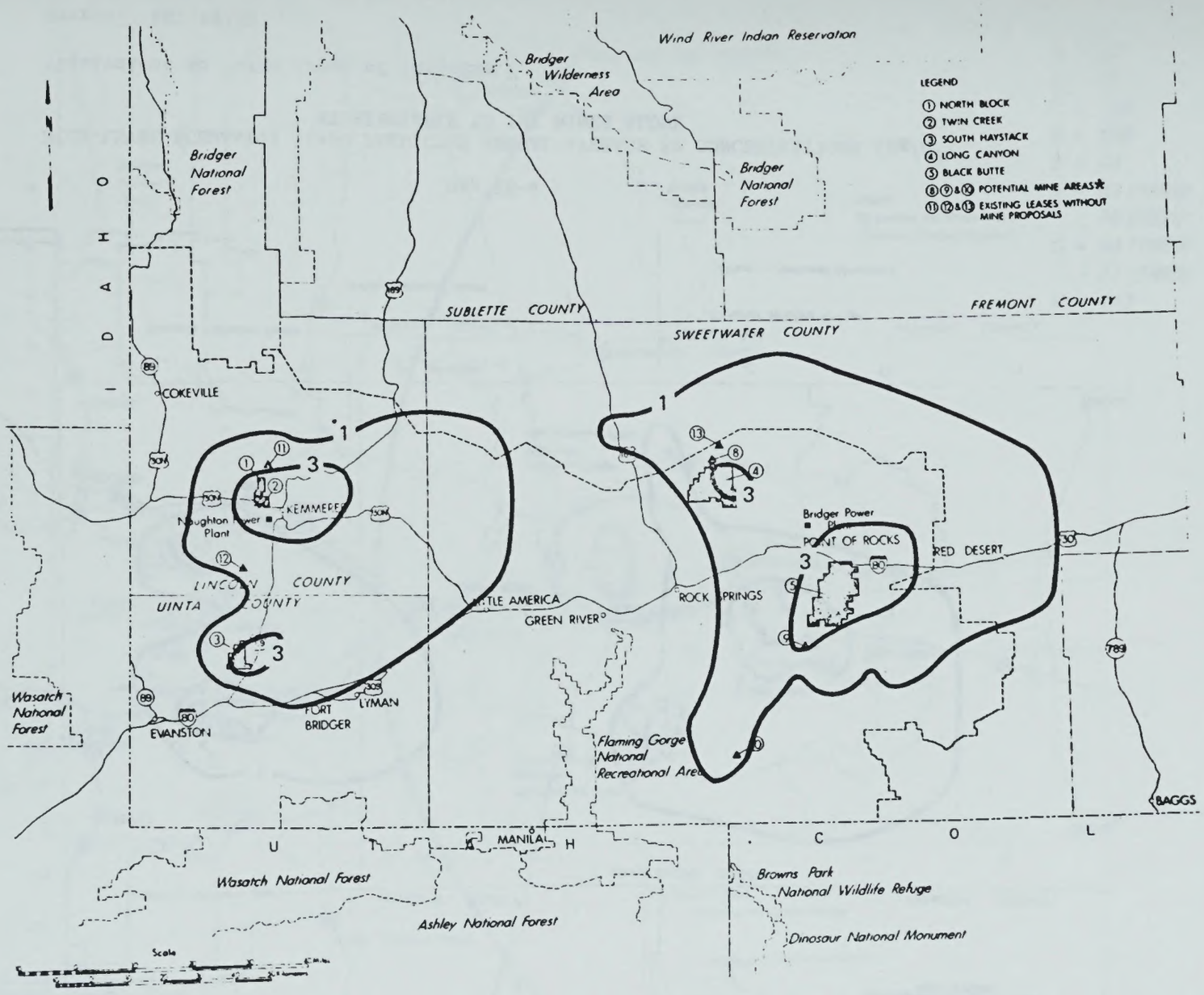
Near the South Haystack Mine, predicted cumulative TSP levels range from 15 to 25 $\mu g/m^3$ for both analysis years. South Haystack alone accounts for one-third of these concentrations; the rest is attributable to background.

Simulated mine concentrations are lowest about the Long Canyon and MRN-10 subregions. When combined with projected background for 1985 and 1990, predicted cumulative levels range from 16 to 26 $\mu g/m^3$, to which the mines in each subregion contribute 3 $\mu g/m^3$.

Cumulative TSP concentrations are predicted to be less than the Wyoming 60 $\mu g/m^3$ and federal 75 $\mu g/m^3$ standards. Except in the vicinity of Black Butte, background sources dominate total predicted TSP levels. The proportional regional impact associated with the development of the mines alone in the high-level scenario is minimal for both analysis years.

Predicted 24-Hour Average Cumulative Impacts on TSP Concentrations. The upper limit for projected industrial background concentrations in Sweetwater County of 225 $\mu g/m^3$ for 1985 and 1990 is greater than the Wyoming standard of 150 $\mu g/m^3$. Corresponding levels in the vicinities of the trona patch and the Jim Bridger Power Plant are simulated to be 6 $\mu g/m^3$ and 20 $\mu g/m^3$, respectively. Therefore, cumulative values are predicted to range from 66 to 231 $\mu g/m^3$ about the trona patch and 80 to 245 $\mu g/m^3$ near the Jim Bridger Power Plant.

Background alone accounts for a major portion of these totals. The second highest background concentrations are projected to occur in the urban areas of Sweetwater County. In the vicinity of Rock Springs, total cumulative levels range from 64 to 119 $\mu g/m^3$. Predicted mine contributions to these levels are less than 14%, and they are attributable primarily to Black Butte. As indicated in earlier sections, maximum mine simulated concentrations of 323 and 264 $\mu g/m^3$ occur approximately 2 miles south of Twin Creek in 1985 and 1990, respec-

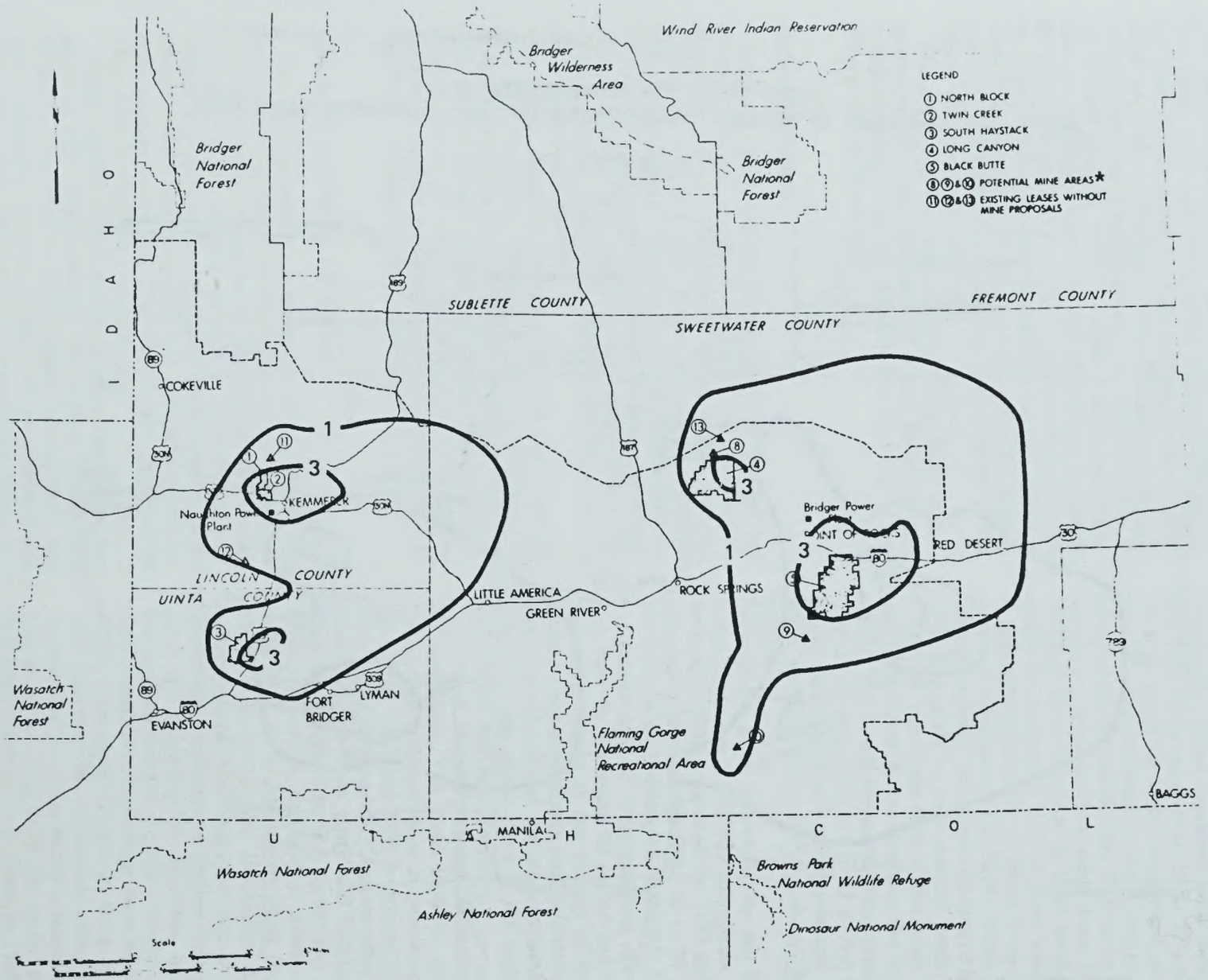


Map R8-3

HIGH-LEVEL SCENARIO: 1985 PREDICTED ANNUAL AVERAGE SP CONCENTRATIONS ($\mu g/m^3$) ATTRIBUTABLE TO THE MINES ALONE

*Equivalent to "mine areas of interest."

Source: ERT 1978b.

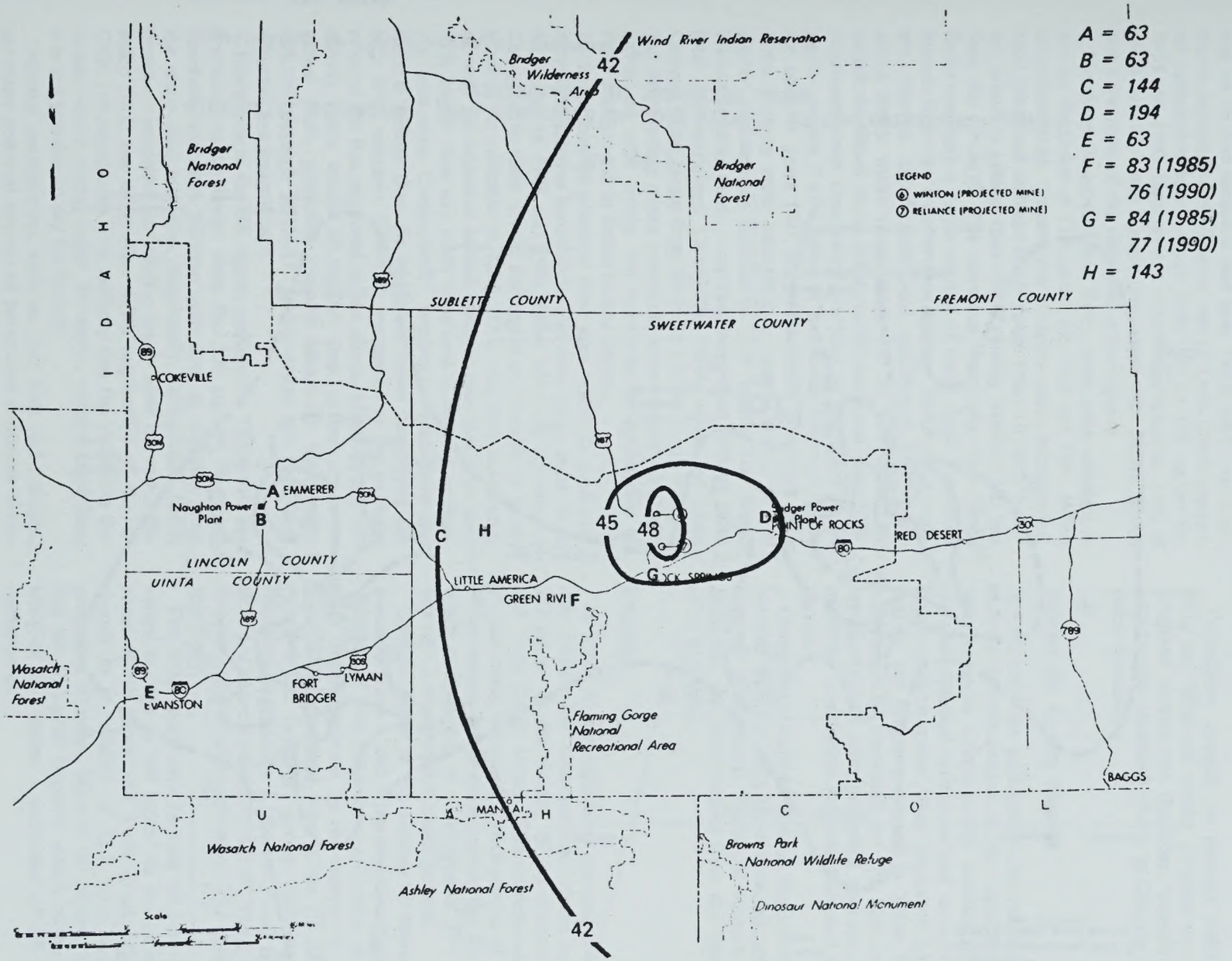


Map R8-4

HIGH-LEVEL SCENARIO: 1990 PREDICTED ANNUAL AVERAGE SP CONCENTRATIONS ($\mu g/m^3$) ATTRIBUTABLE TO THE MINES ALONE

*Equivalent to "mine areas of interest."

Source: ERT 1978b.

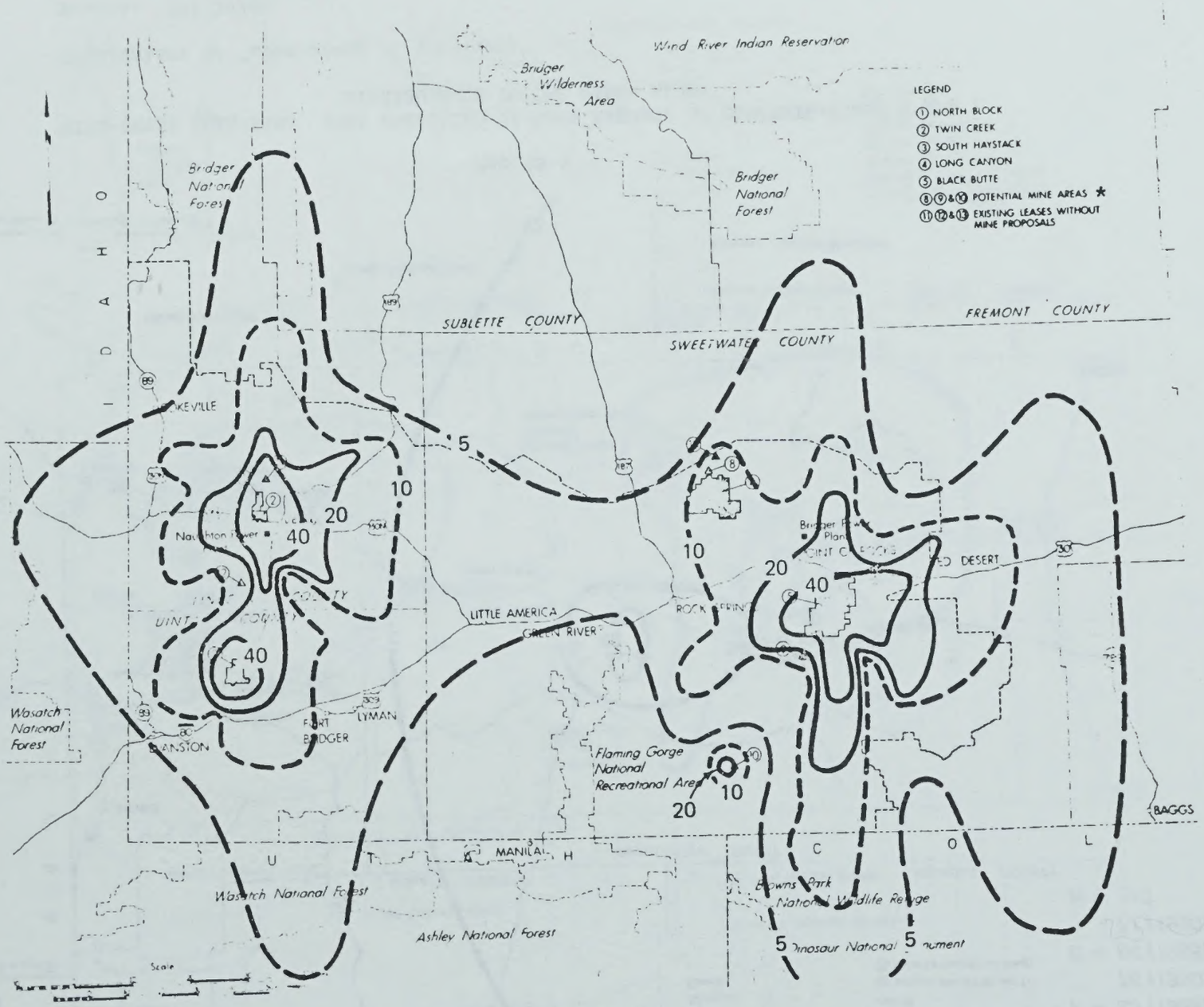


Map R8-5

HIGH-LEVEL SCENARIO: 1985 PREDICTED 24-HOUR AVERAGE SP CONCENTRATIONS (g/m)
ATTRIBUTABLE TO THE MINES ALONE

*Equivalent to "mine areas of interest."

Source: ERT 1978b.



Map R8-6

HIGH-LEVEL SCENARIO: 1990 PREDICTED 24-HOUR AVERAGE SP CONCENTRATIONS ($\mu g/m^3$) ATTRIBUTABLE TO THE MINES ALONE

*Equivalent to "mine areas of interest."

Source: ERT 1978b.

tively. When combined with projected background, resultant total concentrations range from 373 to 398 $\mu g/m^3$ in 1985 and 314 to 339 $\mu g/m^3$ in 1990. The Twin Creek (predominately) and North Block Mines line up under the influence of a northerly wind flow to account for greater than 80% of these total concentrations. Mine MRN-11 has little effect on these total concentrations due to its low emission rate (see Table R8-2). In Kemmerer, approximately 2 miles east of Twin Creek predicted cumulative levels range from 170 to 195 $\mu g/m^3$ for 1985 and 1990. Background contributes less than 30% of these levels; Twin Creek (primarily) and North Block comprise most of the simulated mine impacts.

North-northeast of Black Butte, peak mine simulations are on the order of 120 $\mu g/m^3$ for 1985 and 1990. When combined with Sweetwater County rural background, total predicted ambient levels range from 150 to 175 $\mu g/m^3$, which is greater than the Wyoming standard but less than the NAAQS. The emissions emanating from Black Butte comprise a major portion of these totals. Predicted impact from the mine area of interest (MRN-9) is negligible. Second highest simulated cumulative TSP levels about Black Butte range from 110 to 135 $\mu g/m^3$, to which the Black Butte Mine contributes more than 60%. Maximum mine simulations are also on the order to 80 $\mu g/m^3$ within 2 to 3 miles of the South Haystack Mine for analysis years 1985 and 1990. When combined with Uinta County rural background, ranges of 110 to 130 $\mu g/m^3$ characterize cumulative TSP levels. The South Haystack Mine alone comprises more than 60% of these total concentrations. Cumulative levels about the Long Canyon Mine range from 50 to 75 $\mu g/m^3$. Long Canyon and surrounding mines contribute approximately 10 to 20 $\mu g/m^3$ to such levels, the remainder is attributable to rural background in Sweetwater County.

In the vicinity of potential mine area MRN-10, peak predicted cumulative levels about the mine range from 55 to 80 $\mu g/m^3$ in 1985 and 1990. Mine MRN-10 contributes 25 $\mu g/m^3$ to these levels, the rest is attributable to background. As indicated in Table R8-2, this mine is associated with an estimated annual emission rate that is at least 50% higher than any other mine area of interest or existing lease mine. Consequently, predicted impact from this mine is greater than the additional mines comprising the high level scenario. However, compared to the emission rates of the five proposed action mines, MRN-10 is a relatively minor source of fugitive dust. In fact, on a regional scale, predicted impacts associated with mines MRN-8 through MRN-13, which define the high-level scenario, are insignificant.

Elsewhere in the ES region, cumulative TSP levels are predicted to be lower than the 150 $\mu g/m^3$ Wyoming standard, and they become quite low as distance from the mine sites increases. Regionally, background levels dominate predicted cumulative levels with increased distance from the mine sites. With application of the 43 CFR 118 regulations, it is unlikely that the violations discussed above would occur. However, without modeling, it is not possible to say for certain.

Natural catastrophes, such as coal fires and drought, are other potential sources of particulate emissions. Associated impacts are difficult to assess quantitatively, although maximum air quality degradation would occur on a very local scale. A qualitative discussion relative to such catastrophes is presented in Chapter 4.

Gaseous Pollutant Impacts

Cumulative impacts on gaseous pollutants (CO, HC, NO_2, and SO_2) are similar to those associated with the proposed actions and, therefore, insignificant when compared to the standards. Refer to Chapter 4 for a more detailed discussion.

Indirect Air Quality Impacts

Additional air pollutant emissions would result from indirect sources related to the high-level coal development scenario. Consequently, baseline SP concentrations are also expected to increase and have been projected to future analysis years: these projected levels are equivalent to the ranges presented in Table R4-2A. The SP concentrations simulated for the high-level mines have been combined with projected baseline levels to determine the cumulative impacts discussed in the previous section.

Quantitative indirect source impacts to variations in baseline SO_2 and NO_2 concentrations are unknown (see Chapter 2, Regional Technical Report (ERT 1978a)). However, the contributions from the mines are expected to be negligible.

Visibility

In 1985, for the high-level scenario considered, worst-case 24-hour SP concentrations attain values as high as 323 $\mu g/m^3$ in the vicinity of the proposed North Block and Twin Creek Mines. This corresponds to a visibility of 20.1 miles, assuming a background of 40 miles. Most of the region, however, is outside the 20 $\mu g/m^3$ isopleth, which corresponds to a visibility of 37.7 miles, a reduction of 2.3 miles from the background.

Concentrations in the Bridger Wilderness Area (Class I) are between 1 and 2 $\mu g/m^3$. This level of SP yields a visibility of 39.8 miles for a reduction of less than 0.7% from the background. In the vicinity of Flaming Gorge National Recreational Area (Class II), SP values are between 6 and 7 $\mu g/m^3$, giving visibilities of 39.2 miles (visibility degradation 2.1%). At Fossil Butte, concentrations are approximately 25 $\mu g/m^3$. The computed visibility and visibility degradation are 37.2 miles and 7.1%, respectively.

For 1990, worst-case 24-hour SP concentrations attain values as high as 264 $\mu g/m^3$ in the vicinity of the proposed North Block and Twin Creek Mines. This corresponds to a visibility of 22.1 miles, assuming a background of 40 miles. Most of the region, however, is outside the 20 $\mu g/m^3$ isopleth, which corresponds to a visibility of 37.7 miles, a reduction of 2.3 miles from the background.

Concentrations in the Bridger Wilderness Area (Class I) are about 1 $\mu g/m^3$. This level of SP yields a visibility of 39.9 miles, for a reduction of less than 0.3% from the background. In the vicinity of Flaming Gorge National Recreational Area (Class II), SP values are between 3 and 4 $\mu g/m^3$, giving a visibility of 39.5 miles (visibility degradation 1.3%). At Fossil Butte, concentrations are approximately 22 $\mu g/m^3$. The computed visibility and visibility degradation are 37.5 miles and 6.3%, respectively.

Paleontology

Both adverse and beneficial impacts would occur to paleontological resources in approximate proportion to the level of regional development and the area disturbed.

Soils

Future population increases in the region would result in the removal of approximately 1,550 acres of soil surface by 1980 (of which 550 acres would result from development of areas of interest), approximately 2,650 acres by 1985 (of which 1,150 acres would result from development of areas of interest), and approximately 3,500 acres by 1990 (of which 1,500 acres would result from development of areas of interest). This permanent loss of soil surface would result from the construction of housing and support facilities. Also, an increase in population would result in greater use of the region's soils for recreation, particularly by off-road vehicles. The amount of impact on soils that would result from recreation is unknown.

Major disturbance and alteration of soils as a result of mining would cause a short-term reduction in soil productivity on the affected soils. Soil productivity would be reduced on 6,750 acres by 1980 (of which 1,783 acres would result from development of areas of interest), on 17,676 acres by 1985 (of which 11,109 acres would result from development of areas of interest), and on 23,120 acres by 1990 (of which 16,420 acres would result from development of areas of interest). On a regional basis these impacts would be considered minor.

Water Resources

Water requirements for coal mines and related growth which would evolve from development of new coal mines in the areas of interest would be as follows: 3,074 acre-feet by 1980, 5,293 acre-feet by 1985, and 5,316 acre-feet by 1990. This is a maximum increase of 5,316 acre-feet per year or a 6.54% increase above the no-action alternative. This increased demand for available water would not create a significant impact upon southwestern Wyoming.

Vegetation

Terrestrial

The proposed actions would result in the removal of native vegetation and loss of productivity for varying periods of time on an estimated 4,956, 17,325, and 23,197 acres by 1980, 1985, and 1990, respectively. Approximately 0.4% of the region's surface acreage would be disturbed by 1990. Additional disturbance of native vegetation would occur as a result of increased outdoor recreation (particularly off-road vehicle travel). Disturbed lands would be reclaimed at an estimated rate of 1,241 acres by 1980, 5,324 acres by 1985, and 11,471 acres by 1990 (approximately 49% of the lands disturbed by 1990 would be reclaimed).

Total surface disturbance in the region resulting from the proposed actions and other activities would result in the removal of native vegetation on an estimated 21,758, 50,677, and 73,432 acres by 1980, 1985, and 1990, respectively, (due to lack of data, figures do not include outdoor recreation disturbances). The proposed actions would constitute about 23% (4,956 of 21,758 acres), 34% (17,325 of 50,677 acres), and 32% (23,197 of 73,432 acres) of the regional surface disturbance by 1980, 1985, and 1990, respectively.

Reclamation would be conducted generally on an ongoing basis. It is estimated that 1,241, 10,991, and 31,111 acres (42% of the acres disturbed by 1990) would be reclaimed by 1980, 1985, and 1990, respectively.

The removal of native vegetation and losses of vegetative production would affect numerous living and nonliving components of the environment. (See Vegetation section, Chapter 4, for reclamation problems and predictions of success.)

Aquatic

Data are lacking with which to quantify or qualify impacts from the proposed actions and other disturbance activities to algae and other aquatic vegetation in seasonal stream drainages.

Endangered and (or) Threatened Species

Under Section 7 of the Endangered Species Act of 1973, the Secretary of the Interior will grant no approval which would jeopardize the continued existence of any endangered and (or) threatened species or result in the destruction or modification of their critical habitat.

Fish and Wildlife

The proposed actions and other activities would cause the direct loss of wildlife habitat, wildlife carrying capacity, and fish and wildlife populations on 21,758, 50,677, and 73,432 acres by 1980, 1985 and 1990, respectively. Indirect losses (area of influence) would be 98,902,

227,963, and 330,487 acres by 1980, 1985, and 1990, respectively.

Population losses would be estimated at 45,000, 263,000, and 381,000 small nongame birds; 3,000, 6,200 and 10,600 sage grouse; 2.5 million, 14.3 million, and over 20 million small nongame mammals; 820, 2,575, and 4,175 antelope; 520, 1,700, and 2,740 deer; and 76,000, 276,000, and 401,000 reptiles and amphibians by 1980, 1985, and 1990, respectively. There would be a loss of 1,200 raptors, 200 elk, and 20 moose by 1990.

The proposed actions and other potential coal actions would account for 23% (4,956 acres), 34% (17,325 acres), and 33% (24,197 acres) of the total disturbance by 1980, 1985, and 1990, respectively. Fish and wildlife population losses would be estimated at 10,300, 90,000 and 126,000 small nongame birds; 0.56 million, 4.9 million, and 6.8 million small nongame mammals; and 39,000, 92,000, and 130,000 reptiles and amphibians by 1980, 1985, and 1990, respectively. The above population losses account for 23%, 34%, and 33% of the total cumulative by 1980, 1985, and 1990, respectively. The proportion of losses for other animal species caused by the proposed actions and other potential federal coal actions would depend on the species involved. Sage grouse losses would be 2,450 3,500, and 6,600 birds or 31%, 56%, and 62% of the total cumulative by 1980, 1985, and 1990, respectively. Raptor losses would be 1,200 or 100% of the total cumulative and remain constant through 1990. Antelope losses would be 520, 1,675, and 2,775 animals or 65%, 70%, and 70% of the total cumulative for 1980, 1985, 1990, respectively. Deer losses would be 270, 900, and 1,440 animals or 54%, 58%, and 56% of the total cumulative by 1980, 1985, and 1990, respectively. Elk losses would be 160 animals or 100% of the total cumulative and remain constant through 1990. Moose losses would be 20 animals or 100% of the total cumulative by 1980 and remain constant through 1990.

To place these population losses in perspective, they must be viewed in their relationship to total populations and assumptions of progeny for the region.

Given the same assumptions as shown in Chapter 4 for population densities, replacement (turnover) and progeny which would be produced over the analysis period, comparison of individuals lost to regionwide projections of numbers would indicate a very small percentage of the total regional population to be affected (for precise percentage figures see Table R4-8C).

Endangered and (or) Threatened Species

Under Section 7 of the Endangered Species Act of 1973, the Secretary of the Interior will grant no approval which would jeopardize the continued existence of any endangered and (or) threatened species or result in the destruction or modification of their critical habitat.

Cultural Resources

In the high-level scenario a total of 435 sites have been identified in areas to be disturbed by mining. It is estimated that another 97 sites would be present in unsurveyed areas of coal interest.

Archeological surveys, if properly conducted, are mitigations in that surveys provide for locating, recording, and surface collection of sites. Many surveys include subsurface testing as an evaluatory procedure. Through the collection of such scientific data impacts to sites are reduced. Such activities do not preclude the need for additional mitigation measures; however, for many sites they may provide sufficient mitigation.

Destruction of sites would occur as a result of mining activities. Of these 435 sites, 38 are threatened with complete physical destruction by 1980, 85 by 1985, and 176 by 1990. The remainder are threatened with physical destruction by their proximity to surface-disturbing activities. The significance of currently uninventoried archeological sites within unsurveyed portions, other potential coal mining areas, or buried sites anywhere in these areas cannot be determined at this time.

Other ongoing activities which will affect archeological and historical resources include oil and gas exploration and development, existing coal mines, and the Viva Naughton Reservoir expansion. The amount of disturbance to archeological and historical resources from these activities is unquantifiable at this time.

Visual Resources

Visual resource contrast ratings would have to be conducted for each area based on a specific mining plan to evaluate which visual elements would be affected by a proposed management activity. This evaluation would show which activities would need to be modified in order to meet the Visual Resource Management (VRM) class objectives for that area. The criteria by which the contrast ratings would be conducted are included BLM Manual 6320. The impacts to the visual resources due to the high scenario would be the same as those due to the proposed actions; however, there would be more areas affected. These areas are shown on Map 1 in Appendix A.

Recreational Resources

More people would travel to the country for recreation. This increase is shown on Table R8-8. The increased use demand would have two basic impacts. First, the increase would greatly reduce the quality of the "primitive"recreational experience which is found throughout southwestern Wyoming. Second, there would be more conflicts between recreationists and landowners due to increased numbers of people crossing private lands; this would prompt landowners to restrict access to and across their private lands.

Agriculture

Table R8-8

SUMMARY OF AREA OF INTEREST IMPACTS AND CUMULATIVE IMPACTS
IN VISITOR DAYS DEMAND FOR SOUTHWESTERN WYOMING WITH HIGH-LEVEL SCENARIO

Elements and Components	1977	1980		1985		1990	
		Area of Interest	Region-wide	Area of Interest	Region-wide	Area of Interest	Region-wide
Fishing	250,300	16,100	294,600	37,300	350,400	37,900	373,400
General[1]	224,700	15,800	288,800	37,200	349,900	38,300	377,600
Hunting	79,100	5,000	90,900	11,200	105,500	11,200	110,600
Off-road vehicles[2]	9,800	600	11,300	1,400	13,200	1,400	13,900
Sightseeing	76,800	4,900	89,100	11,400	106,800	11,600	114,200
Urban	154,500	10,300	188,400	25,600	240,700	27,000	266,300
Water sports	115,500	7,600	138,500	18,300	171,900	19,100	187,900
Winter sports	31,200	2,100	38,700	5,500	51,700	5,900	57,900

Note: Visitor Day consists of 12 hours.

[1]General includes camping, picnicking, etc.
[2]Estimate by ES Team Outdoor Recreation Planner.

Livestock Grazing

Forage for livestock would be lost due to the proposed actions on 4,956, 17,325, and 23,197 acres by 1980, 1985, and 1990, respectively. Regionwide acreage loss would be 21,758, 50,677, and 73,432 acres by 1980, 1985, and 1990, respectively (AUM data are unavailable). Assuming that the carrying capacities of rangelands which would be disturbed by both the proposed actions and other activities are similar, then the proposed actions would contribute to total AUM losses in the region by 23%, 34%, and 32% by 1980, 1985, and 1990, respectively.

Due to the relatively low percent of regional acreage disturbance by 1990 (0.4%) and considering ongoing reclamation, it is felt that coal-related and other disturbances would not significantly affect regional livestock production through the loss of AUMs.

Other factors (as shown in the Agriculture section, Low-Level scenario) would cause inconveniences and hardships to livestock operators of the region but would not significantly affect regional livestock production.

Prime Farmland

Data are lacking with which to determine if other activities would affect prime farmlands.

Transportation Networks

The actual impacts to transportation networks would result from population increases. Table R8-9 shows the estimated increase in number of vehicle registrations due to other potential coal development in the region. This table also compares the high-level scenario to the low-level scenario. The increased use would lead to a proportionate increase in the number of accidents. Increased highway use would also lead to the need for more maintenance as the heavy use breaks down the roadbed. Local ranchers would become irritated with increased traffic across their private lands and would tend to limit access across their lands.

Table R8-10 depicts the estimated future rail traffic through the southwestern Wyoming ES region.

Mineral Resources

Coal mining in the high-level scenario would not significantly impact other mineral resources. The impact of mining approximately 380 million tons of coal through 1990 would result in the reduction of about 470 millions tons of coal reserves because of the inherent loss of coal in the mining operations. This is about 0.27% of the Wyoming coal reserves between 0 and 3,000 feet of overburden.

However, energy obtained from the production of the 380 million tons (210 million tons from federal approvals) would be available for homes, institutions, and industry. This would be equivalent to approximately 114,000 megawatts of electricity.

Socioeconomic Conditions

Population

The employment increases with the activities under the high-level scenario, along with natural growth, should cause the population to increase as shown on Table R8-11. The region would grow at an annual rate of 5.2% through 1980; its rate would steadily decrease thereafter. By 1990, population would stabilize at 85,303 (the annual growth rate would be a minimal 1.1%).

Employment

Total employment in the region would reach 33,085 by 1980, 38,519 by 1985, and 40,541 by 1990. These would be significant increases over the 1977 figure of 28,118. The unemployment rate would be reduced between 1980 and 1990. More jobs with higher salaries would become and remain available in the region.

Income

Total personal earned income would increase to $446.6 million by 1980, $600.7 million by 1985, and $719.0 million in 1990. These are respective increases of 30.3%, 75.2%, and 109.7% over the 1977 figure of $342.8 million. These significant increases would be attributed to a larger population with a larger percent of it earning the higher wages offered by the mining industry. Per capita income would also rise significantly (up to 60%).

Infrastructure

Private Sector. Retail sales would increase to $220.4 million by 1980, $336.4 million by 1985, and $462.7 million by 1990. The 1990 value would be significantly (285%) greater than the $162.6 million figure of 1977.

Housing. Housing requirements would be 4,104 units greater by 1980, 9,066 greater by 1985, and 10,994 greater by 1990 than the 1977 figure of 14,105 units. The significantly higher demand would cause the price of homes to increase and shortages to occur. Shortages would force new residents to accept inferior housing and make greater use of mobile homes.

Education. School enrollment would increase by 2,184 students by 1980, 4,745 by 1985, and 5,351 by 1990 over the 1977 figure of 11,390. By 1980, 105 classrooms would be needed to support the increased enrollment. By 1985, 221 classrooms would be needed; 246 would be needed in 1990.

Health Care. Requirements for physicians and dentists would increase from 40 in 1977 to 47 in 1980, 56 in 1985,

Table R8-9

COMPARISON OF HIGH-LEVEL AND LOW-LEVEL SCENARIOS
INCREASES IN VEHICLE REGISTRATIONS

	1976	1980	1985	1990
Low-level scenario	52,500	59,600	65,800	69,700
Increased sales due to development of areas of interest	NA	3,500	7,800	7,900
High-level scenario	NA	63,100	73,600	77,600

NA = Not Applicable

Table R8-10

ESTIMATED TRAIN VOLUME ON TRACK SEGMENTS OF THE UNION PACIFIC RAILROAD IN TRAINS PER DAY
DUE TO THE HIGH LEVEL SCENARIO

Segment	Estimated Capacity[1]	Current Traffic[1,2]	1980			1985			1990		
			Projected Volume Without Coal[3,4]	Number of Coal Trains[1]	Coal Trains Due to Area of Concern[3,4]	Projected Volume Without Coal[3,4]	Number of Coal Trains[1]	Coal Trains Due to Area of Concern[3,4]	Projected Volume Without Coal[3,4]	Number of Coal Trains[1]	Coal Trains Due to Area of Concern[3,4]
Kansas City to Topeka	70-80	44	48	2.6	0.5	56	1.8	0.5	65	1.6	0.5
Topeka to Gibbon	70-80	22	24	5.0	0.5	28	7.6	0.5	32	7.0	0.5
Council Bluffs to Gibbon	55-60	34	37	10.8	1.9	43	11.0	2.7	50	10.2	2.7
Gibbon to North Platte	70-80	53	58	16.0	2.4	67	18.4	3.2	78	17.6	3.2
North Platte to Cheyenne	70-80	47	51	12.8	2.4	60	12.2	3.2	69	11.4	3.2
Cheyenne to Hanna	70-80	51	56	13.4	2.4	65	12.8	3.2	75	11.4	3.2
Hanna to Rawlins	70-80	45	49	6.2	2.4	57	5.2	3.2	66	5.8	3.2
Rawlins to Rock Springs	70-80	44	48	6.2	2.4	56	6.2	3.2	65	6.8	3.2
Rock Springs to Green River	70-80	44	48	1.4	2.2	56	2.6	3.0	65	3.4	3.0
Green River to Granger	70-80	40	44	1.8	2.2	51	3.0	3.0	59	3.8	3.0
Granger to Kemmerer	25-30	13	14	2.6	2.2	16	4.6	3.0	19	6.8	3.0

Table R8-10

ESTIMATED TRAIN VOLUME ON TRACK SEGMENTS OF THE UNION PACIFIC RAILROAD IN TRAINS PER DAY DUE TO THE HIGH LEVEL SCENARIO
(Continued)

Segment	Estimated Capacity[1]	Current Traffic[1,2]	1980			1985			1990		
			Projected Volume Without Coal[3,4]	Number of Coal Trains[1]	Coal Trains Due to Area of Concern[3,4]	Projected Volume Without Coal[3,4]	Number of Coal Trains[1]	Coal Trains Due to Area of Concern[3,4]	Projected Volume Without Coal[3,4]	Number of Coal Trains[1]	Coal Trains Due to Area of Concern[3,4]
Kemmerer to Pocatello	25-30	13	14	1.4	3.3	16	2.8	5.3	19	4.0	5.3
Pocatello to Hinkle	25-30	15	16	2.8	3.3	19	5.8	5.3	22	9.4	5.3

[1]Union Pacific Railroad Company 1978.
[2]Through Freight only.
[3]Abt Associates 1978.
[4]Estimates by ES Team.

Table R8-11

HIGH LEVEL SCENARIO-PROJECTED POPULATION: SOUTHWESTERN WYOMING ES REGION

	1977	1980		1985		1990	
	Estimated Population	Population Projection	Impact of High Level Scenario	Population Projection	Impact of High Level Scenario	Population Projection	Impact of High Level Scenario
Sweetwater County	41,263	47,305	1,985	58,274	5,323	62,696	5,410
Rock Springs	25,996	29,909	1,357	36,908	3,549	39,702	3,612
Green River	12,502	14,185	453	17,440	1,396	18,769	1,411
Balance of county	2,765	3,211	175	3,926	378	4,225	387
Lincoln County	7,132	8,718	919	8,470	1,350	8,561	1,328
Kemmerer/ Diamondville	3,655	4,829	833	4,871	1,224	4,910	1,204
Balance of county	3,477	3,889	86	3,599	126	3,651	124
Uinta County	11,521	13,270	889	14,150	1,936	14,046	1,911
Evanston	5,918	6,987	627	7,639	1,365	7,582	1,348
Lyman	2,392	2,727	156	2,876	340	2,855	335
Mountain View	677	768	40	805	87	799	86
Balance of county	2,534	2,788	66	2,830	144	2,810	142
Regional Totals	59,916	69,293	3,793	80,894	8,609	85,303	8,649

Source: Abt Associates 1978.

Note: Impact of High-Level Scenario = Projection for high-level scenario - projection for no-action alternative (see Table R8-5).

and 59 in 1990. The increased population would cause moderate pressures on all health care facilities.

Law Enforcement. Personnel requirements would be nearly 43% greater by 1990. The incidence of crime would be expected to increase along with the increase of population.

Fire Protection. Regional fire protection personnel requirements would increase by over 38% by 1990. Increases would be directly related to population and community size increases.

Sewer and Water Systems. Data indicate that most communities would experience increased needs that would require expansion or replacement of their systems. This could be a significant impact if funds are not made available to the affected communities.

FISH AND WILDLIFE MITIGATION ALTERNATIVE

This alternative lists recommendations which, if implemented, would greatly reduce or totally eliminate the major impacts to existing fish and wildlife resources described in Chapters 4 through 7 by enhancement of the wildlife habitat and carrying capacities of those lands adjacent to the proposed mining operations or on nearby off-site locations.

1. That all mining areas be reclaimed to wildlife habitat (see vegetative species list in Chapter 8 of each site-specific ES) as soon as possible or feasible. Reclamation would be in conformance to the post-mining land use set out in BLM's land use plans for the area. Vegetative planting and reclamation should be accomplished in consultation with the Wyoming Game and Fish Department, Wyoming Department of Environmental Quality, and U.S. Fish and Wildlife Service. The goal of reclamation should be to achieve the highest possible wildlife carrying capacity at the earliest possible date, regardless of cost. All possible tools to achieve this goal should be implemented as needed.

2. That approximately 22,000 acres of public lands lying in immediate association with the proposed five special mining areas or on nearby off-site locations be set aside as mitigation areas and managed intensively for fish and wildlife resources (Table R8-12). Selection of these mitigation areas should be accomplished in consultation with the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service.

3. That the mitigation areas be managed to increase their wildlife carrying capacity by at least 50%. Management tools such as water development, fertilization, vegetative manipulation, spraying, transplanting, seeding, protection of wildlife cover, and management of livestock grazing to enhance wildlife habitat should be implemented as necessary. The habitat of these mitigation areas should be managed by the BLM and the wildlife by the Wyoming Game and Fish Department.

4. That mine permits will not be granted on land critical to the bald and golden eagle's ecological requirements. A qualified team of biologists from the Fish and Wildlife Service, Wyoming Game and Fish Department, and the Bureau of Land Management will judge and recommend the areas to be excluded from mining. Mine permits may be granted for these areas if regulations are adopted that provide for substitute mining practices, buffer zones, prey base, and alternate nest sites.

If this alternative is successfully implemented it is estimated that 80% to 90% of the fish and wildlife resource impacts described in Chapters 4 through 7 could be mitigated. Impacts to other resources would be the same as the proposed actions.

DEFER FEDERAL ACTION ALTERNATIVE

A. For proper causes, the Secretary may defer final action on a proposed mining and reclamation plan. These could include, but are not limited to, the need and time required for:

1. modification of the proposal to correct administrative or technologic deficiencies;

2. modification to reduce or avoid environmental impacts, such as:

a. Projected housing shortfall—the proposed actions would be deferred until the existing housing market provided sufficient adequate housing for the projected population, or the mining companies, themselves, took sufficient measures to insure that adequate housing would be provided their employees and families.

b. Financial assistance to communities—the proposed actions would be deferred until communities were assured of adequate front-end monies by federal and state agencies to provide required services and facilities (new or expanded) to ensure the health and welfare of citizens.

c. Reclamation—the proposed actions would be deferred until it was demonstrated that reclamation was reasonably assured;

reached with reasonable assurity;

3. acquisition of additional data to provide an improved basis for technical or environmental evaluation of impacts; and

4. development of an adequate system to monitor impacts for management and regulation, such as water or air monitoring systems.

Table R8-12

PROPOSED MITGATION AREAS

Location	Acreage
Black Butte Mine	11,200
South Haystack Mine	3,300
Twin Creek Mine	3,900
North Block Mine	2,600
Long Canyon Mine	1,000
Total	22,000

The principle effect of deferring action on a proposed mining and reclamation plan on these grounds would be a delay in the imposition of all related impacts of the proposal, both adverse and beneficial, or a reduction or change in the impacts.

SOCIOECONOMIC MITIGATION ALTERNATIVE

The purpose of this alternative is to present several measures that could be taken by federal, state, and local governments and the mining industry to mitigate some of the anticipated socioeconomic impacts of the proposed actions. Any or all of the measures could be applied along with other actions that would be used to lessen impacts (see Defer Federal Action Alternative).

Federal

The amendments to the BLM Organic Act authorize the Federal Government to loan to States and (or) local communities an amount equal to the projects' federal mineral collections for an ensuing 10-year period. Such loans would be made at low interest rates, with an amortization period to be established by law. The loans could be used for planning, construction, and maintenance of public facilities, and the provision of public services in communities impacted by development of federal minerals. The use and allocation of loan funds is currently under study by the United States Congress.

State and Local

State Loans and Grants from the Farm Loan Board

Loans and grants from severence tax and mineral leasing revenues have been and are likely to continue to be the easiest source for cities for large capital outlays. The projections of city finances for future years suggest that a substantial number of grants, rather than loans, are needed. Since the projected mines would contribute to these revenues, some of the cities' capital needs could be met by the Farm Loan Board.

Federal Grants for Utilities Construction

The State could give priority to cities for federal grants such as EPA projects. This, however, might involve refusing some funds to other municipalities.

Expansion of Municipalities' Share of Mineral Leasing Royalties

Newly enacted State legislation allocating a share of leasing royalties to affected municipalities would in part mitigate revenue imbalances. An increase in the portion of leasing royalties that goes to municipalities (now 7.5%) would further mitigate revenue imbalances.

Increased Jurisdiction for the Wyoming Industrial Siting Commission

The Siting Commission does not currently have jurisdiction for development with capital costs of less than about $58 million. Capital costs for new coal mines in the three counties are expected to be below this level. Reducing the legal minimum capital investment in the Siting Commission's enabling legislation would give the commission power to require a larger role by applicants in mitigating impacts.

Special District Legislation

Legislation, which enables special tax districts to be formed that include cities and the areas of the proposed mines would allow property tax revenues from the new mines to be used for general municipal purposes.

Sweetwater, Lincoln, and Uinta Counties could act through the Joint Powers Board to pay for all or part of new capital facilities, such as utilities systems.

Optional Local Tax

Cities can enact or continue to pass their optional 1% sales tax (the tax must be resubmitted to city voters every 2 years) and to earmark those funds for local capital projects.

Industry

Other industries have, and the applicants could, act as resources of last resort to cities, providing assistance where other options are not available. This assistance could include finances, the construction of housing, or needed public improvements.

Mining companies and others involved in major energy-related developments could be made responsible for contacting local government in advance of projects to show how adverse impacts will be mitigated. Industry could pay specialists, retained by local government, to identify and evaluate potential impacts.

In general, such measures would provide revenues for increased social services and thus would potentially reduce the impacts of rapid regional population growth.

COMPARISON TABLE OF IMPACTS

The Comparison Table of Impacts (Table R8-13) is presented to provide the reader with a quick reference to a partial listing of major impacts of levels of analysis for the proposed actions, the regional cumulative, the no-action low scenario, the high scenario of coal only, and the high scenario cumulative. Where data were not avail-

Table R8-13

COMPARISON TABLE OF IMPACTS
(Partial Listing)

		Proposed Action			Regional Cumulative			No Action Alternative Low Scenario			COAL High Scenario			Cumulative High Scenario		
	Units	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990
Air Quality-total suspended particulate emissions	Tons/year	8,256	11,223	9,843	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Paleontology-loss of fossils due to collecting and mining	Sites	NA	NA	139	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Topography-subsidence due to underground mining	Acres	NA	NA	3,680	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Topography-surface disturbed Total	Acres	6,719	14,010	18,485	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Soil-reduced productivity	Acres	1,783	7,459	11,780	6,750	14,026	18,480	4,967	6,567	6,700	1,783	11,109	16,420	6,750	17,676	23,120
Soil-soil surface required for increased population	Acres	350	750	1,100	1,350	2,250	3,100	1,000	1,500	2,000	550	1,150	1,500	1,550	2,650	3,500
Water-estimated water withdrawal	Acre-feet	544	766	766	1404,561	1415,792	1416,172	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water-projected change in water use	Acre-feet	2,866	4,858	5,040	74,740	85,792	86,351	NA	NA	NA	3,074	5,293	5,316	74,948	86,227	86,627
Vegetation-acres of vegetation removal	Acres	4,756	10,895	15,917	21,558	44,247	65,152	16,802	33,352	49,235	4,956	17,325	23,917	21,758	50,677	73,432

Table R8-13

COMPARISON TABLE OF IMPACTS
(Partial Listing)
(Continued)

		Proposed Action			Regional Cumulative			No Action Alternative Low Scenario			COAL High Scenario			Cumulative High Scenario		
	Units	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990
Socioeconomic-additional units of housing needed	Housing units	2,635	1,060	6	25,714	29,578	30,024	3,529	5,105	5,545	NA	NA	NA	NA	NA	NA
Socioeconomic-Increased school enrollment	Students	NA	NA	NA	16,255	18,240	17,966	2,271	3,289	3,306	NA	NA	NA	NA	NA	NA
Socioeconomic-Increased number of physicians and dentist needed	Doctors and Dentists	15	24	25	125	144	145	110	120	120	NA	NA	NA	NA	NA	NA
Socioeconomic-increased number of law enforcement personnel needed	Law officers	30	62	53	251	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = Not Available
NC = No Change
V = VRM Class V

Table R8-13

COMPARISON TABLE OF IMPACTS
(Partial Listing)
(Continued)

		Proposed Action			Regional Cumulative			No Action Alternative Low Scenario			COAL High Scenario			Cumulative High Scenario		
	Units	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990
Wildlife-number of antelope lost	Number antelope	165	685	1,370	465	1,600	2,770	300	900	1,400	520	1,675	2,775	820	2,575	4,175
Wildlife-number of deer lost	Number deer	200	540	850	450	1,340	2,150	250	800	1,300	270	900	1,440	520	1,700	2,740
Wildlife-number of elk lost	Number elk	65	100	160	65	100	160	NA	NA	NA	160	160	160	NA	NA	200
Wildlife-number of moose lost	Number moose	NA	NA	20	NA	NA	20	NA	NA	NA	20	20	20	NA	NA	20
Wildlife-total number of reptiles and amphibians lost	Reptiles and amphibians	25,000	90,000	125,000	62,000	274,000	400,000	37,000	184,000	271,000	39,000	92,000	130,000	76,000	276,000	401,000
Cultural-number of archeological sites threatened by destruction	Sites	27	57	106	83	203	316	56	146	210	38	85	176	NA	NA	NA
Cultural-number of historical sites with potential disturbance	Sites	NA	NA	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Visual-VRM class change from present on disturbed lands	Change to VRM class	V	V	V	V	V	V	NC	NC	NC	V	V	V	V	V	V
Recreation-number of recreation visitor days for fishing	Visitor days	16,000	30,900	31,500	294,500	344,000	367,000	278,500	313,000	335,500	16,100	37,300	37,900	294,600	350,400	373,400

Table R8-13

COMPARISON TABLE OF IMPACTS
(Partial Listing)
(Continued)

		Proposed Action			Regional Cumulative			No Action Alternative Low Scenario			COAL High Scenario			Cumulative High Scenario		
	Units	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990
Recreation-number of recreation visitor days for general activities	Visitor days	15,700	30,900	31,900	288,700	343,600	391,200	273,000	312,700	339,300	15,800	37,200	38,300	288,800	349,900	377,600
Agriculture-number of AUMs lost	AUMs	529	3,600	7,399	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minerals-annual coal production	Million tons	10.8	15.2	15.2	24.0	31.2	31.2	13.2	16.0	16.0	10.8	19.6	19.6	24.0	35.6	35.6
Transportation-estimated vehicle registration increase	Vehicles	3,400	6,500	6,600	63,000	72,300	76,300	59,600	65,800	69,700	3,500	7,000	7,900	63,100	73,600	77,600
Socioeconomic-total increase in population	People	7,666	13,831	13,783	75,852	86,643	87,325	68,186	72,812	73,542	8,457	15,319	15,268	77,143	88,735	89,474
Socioeconomic-total increase in employment	Jobs	4,564	7,606	7,550	36,840	42,022	42,453	32,276	34,416	34,903	NA	NA	NA	NA	NA	NA
Socioeconomic-total increase in income	Million dollars	155.8	245.5	266.9	614.1	775.2	847.5	458.3	529.7	580.6	NA	NA	NA	NA	NA	NA
Socioeconomic-increase in retail sales	Million dollars	93.5	147.3	160.1	368.5	465.1	508.5	275	317.8	348.4	NA	NA	NA	NA	NA	NA

Table R8-13

COMPARISON TABLE OF IMPACTS
(Partial Listing)
(Continued)

		Proposed Action			Regional Cumulative			No Action Alternative Low Scenario			COAL High Scenario			Cumulative High Scenario		
	Units	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990	1980	1985	1990
Vegetation-acres of disturbed land which would be reclaimed	Acres	341	3,334	8,871	NA	NA	NA	900	5,667	19,640	1,241	5,324	11,471	1,241	10,991	31,111
Wildlife-loss of fish and wildlife habitat and carrying capacity-directly	Acres	4,756	10,895	15,917	21,558	44,247	65,152	16,802	33,352	49,235	4,956	17,325	23,197	21,758	50,677	73,432
Wildlife-loss of fish habitat and carrying capacity affected-indirectly	Acres	21,420	49,028	71,626	97,011	199,111	293,184	16,802	3,352	49,235	22,302	77,963	108,887	98,902	227,963	330,487
Wildlife-estimated loss of nongame birds	Number birds	8,300	59,500	112,400	53,300	289,000	452,400	45,000	230,000	340,000	10,300	90,000	126,000	55,300	320,000	466,000
Wildlife-estimated loss of raptor numbers due to elimination of nests	Number Raptors	NA	NA	1,200	NA	NA	1,200	NA	NA	NA	NA	NA	1,200	NA	NA	1,200
Wildlife-number of sage grouse lost	Number sage grouse	1,500	4,800	8,200	2,050	7,500	12,200	550	2,700	4,000	2,450	3,500	6,600	3,000	6,200	10,600
Wildlife-total estimated loss of nongame mammals	Millions mammals	1.2M	7.7M	135M	3.4M	19.2M	29.5M	2.23M	11.5M	16M	.56M	4.4M	6.8M	2.79M	16.4M	22.8M

able to quantify the impact on a certain portion of the impact, the table is so noted.

CHAPTER 9

CONSULTATION AND COORDINATION

This chapter discusses the preparation of the environmental statement (ES) from inception, including team organization and a history of consultation and coordination with other agencies, organizations, and individuals.

The first part of the chapter is devoted to that consultation and coordination done in preparation of the draft ES, and the second is concerned with answering specific comments from public hearings and letters relating to the adequacy of analysis in the draft ES.

TEAM ORGANIZATION

The Wyoming State Director of the BLM was assigned lead responsibility for preparation of this ES. The primary interagency effort involved the BLM and the Geological Survey (USGS). Subsequently, an approach for the effort was developed, including selection of team members and scheduling of actions to follow.

The following items were agreed upon at interagency meetings and subsequently implemented during the course of statement development:

1. A team led by BLM was established representing broad categories of environmental concern including socioeconomics, soils, plants, animals, cultural resources, and recreation. The USGS provided supportive skills in the form of mining engineering, hydrology, and geology. The Fish and Wildlife Service provided support skills in all areas of fish and wildlife.
2. An ES team office was established in the Lea Building, 205 Broadway, Rock Springs, Wyoming.
3. The BLM provided administrative and clerical support.
4. Specialized services to assemble and analyze research material and provide consultant assistance were secured by contract.

PUBLIC COMMENTS AND RESPONSES BEFORE DRAFT ES

On December 16, 1976, a public coal issues meeting was held at Western Wyoming College to discuss proposed coal development in southwestern Wyoming. A coal issues brochure and two news releases were published to solicit attendance at this meeting. About 30 people attended. No significant issues were raised for special attention. A third news release, dated January 24, 1977, was issued to encourage public comments and input to the ES process.

CONSULTATION AND COORDINATION IN THE PREPARATION OF THE ENVIRONMENTAL STATEMENT

During preparation of this environmental statement, federal, state, and local agencies and representatives of private industry were consulted. Individuals with special expertise relating to the proposed actions provided information and additional data. The substantive results of these consultation efforts follow:

1. Lincoln/Uinta County Planner, Glenn Payne. Comments: Mr. Payne advised that there are no county (Lincoln/Uinta) zoning laws to restrict mining on public lands.

2. Sweetwater County Planner, Dennis Watt. Comments: Mr. Watt described procedures for getting zoning change for mining in Sweetwater County. First, the mining company submits zoning change petition. Second, public meetings are held and 30 days prior notice must be given for public input and discussion. Third, unless the local government proves the zoning change would amount to unreasonable extraction, the change is granted.

3. Chief Historian for the Wyoming Recreation Commission, Ned Frost. Comments: Mr. Frost provided a list of cultural sites in Sweetwater, Lincoln, and Uinta Counties. The list includes the Wyoming Historic Preservation Plan and National Register of Historic Places. Legal descriptions of those sites were also provided.

4. University of Wyoming, Paul C. Singleton. Comments: Mr. Singleton supplied information about the effect on soil structure when soil is removed by scrapers and stockpiled. He also discussed the change in soil productivity when areas are reclaimed after mining.

5. University of Montana, Dr. Nellie Stark. Comments: Dr. Stark supplied information on the effect on soil microorganisms by the removal and stockpiling of topsoil.

6. Oklahoma State University, Dr. Wayne Huffine. Comments: Dr. Huffine was asked what percent of ground cover 2 tons per acre of straw would convert to (for use in the Musgrave Equation). He said it would cover the area completely when applied to the surface. But when disced in the percent cover would be reduced below 100%, probably somewhere between 60% and 80%.

7. University of Wyoming, Dr. George Baxter. Comments: Dr. Baxter supplied information concerning species and population densities of fish, reptiles, and amphibians in southwestern Wyoming.

8. University of Wyoming, Dr. Kenneth Diem. Comments: Dr. Diem supplied information concerning small, nongame bird populations in southwestern Wyoming.

9. University of Wyoming, Dr. Jack Turner. Comments: Dr. Turner supplied information concerning species and population densities of small, nongame mammals in southwestern Wyoming.

10. Defenders of Wildlife, Dick Randall, Field Representative. Comments: Mr. Randall reported that he observed two adult peregrine falcons and two fledglings on the northwest side of Black Buttes during the spring of 1972.

11. Rod Ogilvie. Comments: Mr. Ogilvie reported that he observed a peregrine falcon on the west side of Black Buttes in the spring of 1973.

12. Wyoming Game and Fish Department, James June. Comments: Mr. June supplied information concerning population densities for sage grouse.

13. Rocky Mountain Energy Company, subsidiary of Union Pacific Corporation. Comments: Provided mapping data on mylar for several resources which covered checkerboard land ownership within southwestern Wyoming.

14. U.S. Department of Agriculture, Soil Conservation Service, Hal Ravenholt. Comments: Provided prime farmland data for ES region.

15. Bridger Coal Company, Harley Meuret. Comments: Provided reclamation information.

16. U.S. Department of Agriculture, Forest Service, Chandler P. St. John. Comments: Provided livestock grazing data for that portion of the Wasatch National Forest within the ES Region.

17. U.S. Fish and Wildlife Service, Dr. Richard D. Porter. Comments: Dr. Porter supplied information concerning the habitat requirements of the American peregrine falcon.

18. Wyoming State Engineer's Office. Comments: Personnel of the Wyoming State Engineer's office provided data on plans for water development in the southwestern Wyoming region.

COORDINATION IN THE REVIEW OF THE ENVIRONMENTAL STATEMENT

Comments on the draft environmental statement were requested from the following agencies, state clearing house, and interest groups.

Federal

Advisory Council on Historic Preservation*
U.S. Department of Agriculture
  Soil Conservation Service*
  Forest Service*
U.S. Department of Commerce*
U.S. Department of Energy*
U.S. Department of Health, Education, and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
  Bureau of Mines
  Bureau of Reclamation*
  U.S. Fish and Wildlife Service*
  Heritage Conservation and Recreation Service*
  National Park Service*
  Office of Surface Mining*
U.S. Department of Labor
  Mine Safety and Health Administration*
  Occupational Safety and Health Administration
U.S. Department of Transportation*
U.S. Environmental Protection Agency*
Federal Energy Regulatory Commission*
Federal Highway Administration
Interstate Commerce Commission
Mountain Plains Federal Regional Council
Office of Economic Opportunity
Water Resources Council

State

State of Wyoming Clearing House* coordinated comments from all interested state agencies.

Local

Lincoln County Commissioners
Lincoln/Uinta Counties Planning Office
Mayors
  City of Rock Springs
  Town of Evanston
  Town of Green River
  Town of Kemmerer
Sweetwater County Commissioners
Sweetwater County Planning and Zoning Commission*
Sweetwater County Priorities Board
Uinta County Commissioners

Nongovernment Organizations

Alpine Chapter Audubon Society
American Horse Protective Association
American Electric Power Service Corporation
American Fisheries Society*
American Institute of Mining Engineers
American Mining Congress
American Sportman's Club
Arch Mineral Corporation*
Black Butte Coal Company*
Citizens for a Better Environment*
Cumberland Coal Company*
Defenders of Wildlife*
ENACT
Environmental Citizen's Lobby
FMC Corporation*
Friends of the Earth
International Society for the Protection of Mustangs and Burros
Izaak Walton League
Kemmerer Boosters
League of Women Voters
National Audubon Society
National Council of Public Land Users
National Energy Law and Policy Institute
National Environmental Health Association
National Resources and Environmental Council
National Wildlife Federation
National Resources Defense Council
Northern Great Plains--Sierra Club
Powder River Basin Resource Council
Rock Springs Gem and Mineral Club
Rocky Mountain Energy Company*
Society for Range Management
Southwest Wyoming Industrial Association*
Sun Energy Development Company
Sweetwater County Historical Society
The Kemmerer Coal Company*
The Wilderness Society*
The Wyoming Wildlife Federation*

Trout Unlimited
Union Pacific Railroad Company*
Utah Power and Light Company*
Western Wyoming Wonder Wheelers
Wild Horse Organized Assistance
Wild Horses Yes*
Wyoming Outdoor Council
Wyoming Petroleum Association
Wyoming Stockgrowers Association
Wyoming Woolgrowers Association

*Agencies and organizations which delivered hearings testimony and (or) submitted written responses concerning the draft ES.

WHERE COPIES MAY BE INSPECTED

Copies of the final ES are available for public inspection and upon request from the Wyoming State Office, BLM, as long as supplies last.

Wyoming State Office
Bureau of Land Management
P.O. Box 1828
2515 Warren Avenue
Cheyenne, Wyoming 82001
(307) 778-2220 Ext. 2334

Copies are available for inspection only at the following Bureau of Land Management Offices:

Buffalo Resource Area Office
Buffalo, Wyoming 82834
(307) 684-5586

Casper District Office
951 Union Blvd.
Casper, Wyoming 82601
(307) 265-5550

Denver Service Center Library
Bldg. 50, Denver Federal Center
Denver, Colorado 80225
(303) 234-4578

Kemmerer Resource Area Office
Diamondville, Wyoming 82116
(307) 877-3933

Lander Resource Area Office
Lander, Wyoming 82520
(307) 332-4220

Newcastle Resource Area Office
214 West Main
Newcastle, Wyoming 82901
(307) 746-4453

Pinedale Resource Area Office
Molyneux Building
Pinedale, Wyoming 82941
(307) 367-4358

Rawlins District Office
1300 Third Street
Rawlins, Wyoming 82301
(307) 324-7171

Rock Springs District Office
Highway 187N
Rock Springs, Wyoming 82901
(307) 382-5350

Washington Office of Public Affairs
18th and C Street
Washington, D.C. 20240
(202) 343-4151

Worland District Office
1700 Robertson Avenue
Worland, Wyoming 82401
(307) 347-6151

Additional copies are available for public inspection only at the following locations:

Geological Survey
Area Mining Supervisor's Office
8426 Federal Building
125 S. State Street
Salt Lake City, Utah 84138
(801) 524-5646

Director's Office, National Center
12201 Sunrise Valley Drive
Reston, Virginia 22092
(703) 860-7411

District Mining Supervisor's Office
126 Elk Street (Rear)
Rock Springs, Wyoming 82901
(307) 362-7350

Regional Manager's Office
7200 W. Alameda Avenue (Villa Italia)
Lakewood, Colorado 80226
(303) 234-2855

Public Libraries

Albany County Library
405 Grand Avenue
Laramie, Wyoming 82070
(307) 745-8070

Carbon County Library
Courthouse
Rawlins, Wyoming 82301
(307) 324-4756

Laramie County Library
2800 Central Avenue
Cheyenne, Wyoming 82001
(307) 634-3561

Lincoln County Library
Courthouse
Kemmerer, Wyoming 83101
(307) 877-4886

Rock Springs Public Library
400 "C" Street
Rock Springs, Wyoming 82901
(307) 362-6212

Sublette County Library
Box 628
Pinedale, Wyoming 82941
(307) 367-2240

Sweetwater County Library
177 N. Center
Green River, Wyoming 82935
(307) 875-3615

Uinta County Library
36 Tenth Street
Evanston, Wyoming 82930
(307) 789-2770

University of Wyoming Library
University Station
Box 3334
Laramie, Wyoming 82070
(307) 766-3190

Western Wyoming Community College Library
Rock Springs, Wyoming 82901
(307) 382-2121 Ext. 154

PUBLIC COMMENTS AND RESPONSES AFTER DRAFT ENVIRONMENTAL STATEMENT

Copies of the draft ES were sent to those parties shown in the Coordination in the Review of the Draft Environmental Statement section, beginning on 3 April 1978. A total of 703 copies were sent to federal, state, and local government agencies, nongovernment organizations, and individuals for their review and comment. Notice of Availability was published in the Friday, 7 April 1978, issue of the Federal Register on pages 14746 and 14747. The notice announced that the BLM invited written comments to be submitted by 31 May 1978; it also included a schedule of formal public hearings to be held at Rock Springs on 16 May 1978 and at Kemmerer on 17 May 1978. The Federal Register notice also announced that copies of the draft ES would be made available for public review at four BLM offices and nine libraries. Subsequently the review period was extended 15 days to 15 June 1978.

In addition to the Federal Register, publication notices and news releases announcing the hearings and availability of the draft ES were sent to 2 wire services, 22 newspapers, 17 radio stations, and 12 TV stations within the regional news media area, the state of Wyoming, and the Rock Springs District of the BLM. Prior to 13 May 1978, a public service announcement reminding the public of the scheduled hearings was also sent to four radio stations and two TV stations in the Rock Springs District of the BLM. On 24 April 1978 and 1 May 1978, selected ES analysts spoke on two radio programs, one in Rock Springs and one in Green River, discussing preparation of the draft ES and impacts identified in it.

All comments were carefully reviewed. Comments which presented new data, questioned facts and (or) analyses, and raised questions or issues bearing directly upon the draft ES were responsed to in detail. Comments of an editorial nature (i.e., dealing with errors, incorrect information, etc.), if not substantive, were not responded to, though appropriate text changes were made.

PUBLIC HEARINGS ON THE DRAFT ENVIRONMENTAL STATEMENT

Four public hearings were conducted. Table R9-1 summarizes hearing dates, sites, attendance, and numbers of people who gave testimony:

Copies of the full hearing transcripts were made available for public review at the Wyoming State Office, and the Rock Springs District Office of the BLM. Witnesses presented testimony to a thirteen-member panel consisting of staff from the BLM, USGS, and Abt Associates (the socioeconomic contractor). The full hearing transcripts are not reproduced in this final ES due to their length.

All written comments and the hearing transcripts will accompany the final ES through the decision process, to the Secretary of the Interior and the Environmental Protection Agency for review, and copies are also available for public inspection at the Wyoming State Office of the BLM in Cheyenne, Wyoming.

Table R9-1

SUMMARY OF PUBLIC HEARINGS ON THE DRAFT ENVIRONMENTAL STATEMENT ON DEVELOPMENT OF COAL RESOURCES IN SOUTHWESTERN WYOMING

Date	Time	Location	Attendance	Number Testifying
16 May 1978	1:30 p.m.	Rock Springs, Wyoming	33	2
16 May 1978	7:00 p.m.	Rock Springs, Wyoming	20	1
17 May 1978	1:30 p.m.	Kemmerer, Wyoming	20	0
17 May 1978	7:00 p.m.	Kemmerer, Wyoming	13	4
			86	7

SUMMARY OF ORAL AND WRITTEN COMMENTS ON THE DRAFT ENVIRONMENTAL STATEMENT

Federal agency comments on the draft ES focused on compliance with applicable laws and regulations and whether the ES constitutes an adequate analysis of all possible impacts of the proposed actions. The agencies provided comments on the completeness of analysis in their areas of interest.

State of Wyoming agencies expressed concern that the value of wildlife is understated and the reclamation potential is overstated. Specific questions were raised regarding impacts on water resources, cultural resources, socioeconomic patterns, and transportation networks and mitigation of these impacts.

Local government, generally in favor of mining more coal in the region, and the mining companies expressed concern that potential environmental hazards were overstated in the draft ES. Local government, however, expressed concern regarding the hazard of blowing dust and possible understatement of the population figures.

Environmental and conservation group comments ranged from absolutely no mining to proceed with mining, but with great care for the environment. Preserving wildlife habitat and the feasibility of reclamation in the region were specific concerns. Comments included questions regarding coal markets, the threat to Hams Fork and the Shiras moose habitat, and protection for archeological sites and elk winter range.

Comments from individuals were generally not in support of mining in the region; they particularly expressed concern regarding impacts to wildlife.

COMMENTS AND RESPONSES

The remainder of this chapter is devoted to presentation of responses to comments received. Where substantive oral comments and written submissions were received from the same commentor, only the full written statement has been shown in this section. An index of comment letters received is given by federal, state, and local agencies; organizations; and individuals. The comment letters and responses follow.

INDEX TO COMMENT LETTERS

Letter Number	Agency, Organization, or Individual
	Federal
1	United States Department of the Interior, Bureau of Reclamation
2	United States Department of the Interior, Fish and Wildlife Service
3	United States Department of the Interior, Heritage Conservation and Recreation Service
4	United States Department of the Interior, National Park Service
5	United States Department of Agriculture, Forest Service
6	United States Department of Agriculture, Soil Conservation Service, Washington, D. C.
7	United States Department of Agriculture, Soil Conservation Service, Casper, Wyoming
8	United States Department of Commerce
9	United States Department of Energy
10	United States Department of Labor, Mine Safety and Health Administration
11	United States Department of Transportation
12	Federal Energy Regulatory Commission
13	United States Environmental Protection Agency
14	Advisory Council on Historic Preservation
	State of Wyoming
15	Commissioner of Public Lands and Farm Loans
16	Office of Industrial Siting Administration
17	State Conservation Commission
18	State Engineer's Office
19	Game and Fish Department
20	University of Wyoming, Science Library
21	Wyoming Department of Agriculture

Letter Number	Agency, Organization, or Individual
22	Wyoming Recreation Commission
23	Wyoming State Highway Department
	Local
24	Lincoln-Uinta Association of Governments
25	Sweetwater County Planning and Zoning Commission
	Organizations
26	American Fisheries Society
27	Arch Mineral Corporation
28	Black Butte Coal Company
29	Citizens for a Better Environment
30	Cumberland Coal Company
31	Cumberland Coal Company, Rocky Mountain Energy Company
32	Defenders of Wildlife
33	FMC Corporation
34	Rocky Mountain Energy Company
35	Southwest Wyoming Industrial Association
36	The Kemmerer Coal Company
37	The Wilderness Society
38	Union Pacific Railroad Company
39	Utah Power and Light Company
40	Wild Horses Yes
41	Wyoming Chapter of the Sierra Club
42	Wyoming Outdoor Council
43	Wyoming Wildlife Federation
	Individuals
44	Margaret M. Haggard

Letter Number	Agency, Organization, or Individual
45	Russell Hynes
46	Ken Morgan
47	David L. Schein
48	Floyd Schneider
49	Gay Shedden

Several letters were received as the FES went to press. These are attached and responded to as time permitted. Additional responses for these will be prepared as appropriate as part of the official file.

1

United States Department of the Interior

BUREAU OF RECLAMATION
UPPER COLORADO REGIONAL OFFICE
P.O. BOX 11568
SALT LAKE CITY, UTAH 84147

IN REPLY
REFER TO: 743
120.1

MAY 31 '78

Team Leader
Coal ES Team
P.O. Box 1869
Rock Springs, WY 82901

Dear Sir:

The Bureau of Reclamation, Upper Colorado Region, has reviewed the DES for the southwestern coal region of Wyoming and agrees, in general, with the description of the area and the environmental impacts as stated for the five site-specific mines that are proposed for development in southwestern Wyoming. The Region has no specific comments as to the format and presentation of the data contained in the statement.

As a general comment we would suggest that, where possible, data be updated to reflect the current status of conditions found throughout southwestern Wyoming. Specifically, in the area of water development the following are noted:

1

1. Page R1-9, section on water development - The Lyman Project no longer includes the China Meadows as a damsite and reservoir. The Bureau has currently under construction the Stateline Dam on the East Fork of the Smith Fork River. This site replaces the one scheduled for construction at China Meadows which was determined to be environmentally unacceptable.

2

2. Data on water developments in the region should be updated to reflect current planning. The projects and acreages referred to in this section have potential, but are not presently proposed projects.

3

3. Page R2-61 - The section entitled "Prime Farmlands," is misleading. Does this infer that the agricultural lands and irrigated lands in southwestern Wyoming meet the Department of Agriculture's prime farm land designation?

Sincerely yours,

ACTING Hark M. Noble

Regional Director

cc: Commissioner, Washington, D.C., Attention: 150
Director, Office of Environmental Project Review, Office of the Secretary, Department of the Interior, Washington, D.C. 20240

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

Letter 1 Responses

1. Text revised (Regional, Chapter 1).

2. Text revised (Regional, Chapter 1, Other Major Regional Developments).

3. Text revised (Regional, Chapter 2, Agriculture, Farmlands).

2

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Billings Area Office
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101

IN REPLY REFER TO:

ES

May 26, 1978

Team Leader
Coal ES Team
P.O. Box 1869
Rock Springs, WY 82901

Dear Sir:

The following comments are directed toward Draft Environmental Statement concerning Development of Coal Resources in Southwestern Wyoming:

1 Wild horses are feral animals and should not be included under the Fish and Wildlife portion of the statement. Along the same lines, if other animals would be affected by loss of habitat, it follows that horses also would be adversely affected. The draft ES indicated that loss of forage would result in livestock reductions; it follows that feral horses would also suffer similar losses.

2 The statement "No impacts to golden eagles will be allowed under permitting procedures," is not entirely correct. Actions incidental to coal development, such as increased human activity, may cause impacts to eagles even though permits are not allowed.

The Fish and Wildlife Mitigation Alternative is not really an alternative to the proposed action. It is, in reality, a measure proposed to lessen (mitigate) the impacts of the proposed action.

3 Page NB8-3, table NB8-2. Squirreltail (Sitanion hystrix) is a grass; however, it is listed under forbes. This table has a large number of spelling errors also.

Page SH2-49. The last paragraph is repeated.

4 Page SH8-1. Can mining really benefit paleontological resources?

5 A recommendation to monitor wildlife populations before, during, and after mining should be included in the ES. This would assist in determining effects on wildlife populations as well as assist in future ES work.

6 Throughout the ES a questionable technique was used in an effort to quantify wildlife losses over the 20 year mine life. The assumption is made

that all populations of wildlife have a three year turnover. That is, all individuals of a given species will have died out in three years and will have been replaced by their offspring. This appears to be a rather meaningless exercise, because the three year turnover period cannot be universally applied to all wildlife collectively. As such, the figures for wildlife losses over the mine life have little true validity or value.

Sincerely,

Jack Larmoyeux
Acting Area Manager

cc: Bob Berg, Coal Coordinator, Cheyenne, WY
RAL, Coal, Denver, CO
Bob Stewart, Coal Project, OBS, Washington D.C.
Office of Environmental Coordination, FWS, Washington D.C.

Letter 2 Responses

1. BLM management plans call for removal of wild horses in the Salt Wells/ Pilot Butte Management Framework Plan area, except for small isolated populations. These populations are not near any proposed mining; therefore, no impacts to wild horses would be expected.

2. This statement referred only to disturbance directly from mining. A statement is made concerning impacts from actions incidental to coal development (Regional, Chapter 4, Fish and Wildlife section).

3. Table NB8-2 has been revised.

4. A beneficial impact of development would be the exposure of fossil materials for scientific examination and collection which otherwise may never occur, except as a result of overburden clearance, exposure of rock strata, and mineral excavation.

5. Text revised (Regional and site specifics, Chapter 8, Fish and Wildlife Mitigation Alternative).

6. Text revised (Regional and site specifics, Fish and Wildlife, Fish and Wildlife Population Loss).

3

United States Department of the Interior
HERITAGE CONSERVATION AND RECREATION SERVICE
~~BUREAU OF OUTDOOR RECREATION~~
MID-CONTINENT REGION

MAILING ADDRESS:
Post Office Box 25387
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
603 Miller Court
Lakewood, Colorado
Telephone 234-2634

IN REPLY REFER TO:
E30

MEMORANDUM

To: State Director, Bureau of Land Management
Attn: Team Leader, Coal ES Team

From: Assistant Regional Director, Land Use Coordination

Subject: Draft Environmental Statement for the Development of Coal Resources in Southwestern Wyoming (DES 78-9)

As requested in your letter of April 12, 1978, we have reviewed the subject Draft Environmental Statement. The following comments relating to cultural, recreational, and natural resources are submitted for your consideration in preparing the final statement. Pursuant to Secretarial Order 3017, comments on potential National Wild and Scenic Rivers and National Scenic Trails are the responsibility of the National Park Service.

CULTURAL RESOURCES

1 It does not appear that adequate survey to locate, identify and evaluate historic properties was performed for this project or that National Register criteria are being properly applied. Consultation with the State Historic Preservation Officer, National Register and Advisory Council on Historic

2 Preservation is not evident. Mitigation of adverse effects is not being considered for historic sites and improperly applied to archeological properties. This will lead to the loss of significant cultural resources.

3 Because of the magnitude of these problems and the paucity of data presented in the draft environmental statement, we want to review the basic documentation for the project. We request that both historical and archeological survey data be provided to the Chief, Interagency Archeological Services, Office of Archeology and Historic Preservation, Heritage Conservation and Recreation Service in Washington, D.C. We cannot adequately respond to the draft environmental statement without examining the survey data.

State Director, Rock Springs, Wyoming

Survey

4 The Bureau of Land Management recognizes its responsibility to survey all of the areas to be impacted by land-modifying activities and is aware of project impacts such as road, facility, rail, and power line construction. However, it does not appear that the surveys performed for the project are adequate to provide sufficient data to locate, identify, and evaluate according to National Register Criteria, historic properties in the project area. Surveys should be carried out early enough to allow for the evaluation of resources in consultation with the State Historic Preservation Officer and, if needed, the Keeper of the National Register of Historic Places.

5 There is no evidence of this consultation in the report. Early identification and consultation avoid costly project delays and provide for proper treatment of resources.

6 A major problem with the survey data as presented in the report is the lack of a statement outlining an approach to the location, identification, and recovery of data. This plan, which minimally should spell out research problems and methods, provides the necessary theoretical framework for the evaluation of site values against National Register criteria, see (36 CFR 66 and 60.6,63 appendix).

Since there is little known about archeology in this part of Wyoming, the large body of data uncovered in the project-related surveys would seem to provide much needed data to investigate such important problems as the chronology of occupation of the area, inter- and intra-site relationships and the relationship of man to environment.

7 Failure to deal with subsurface archeological sites (TC3-16, NB3-20, TC5-4) may mean that a whole class of significant data will be lost. Furthermore, the fact that the surface was obscured (NB2-15) does not eliminate agency responsibility for cultural resources.

8 In view of the fact that the report recognizes the significance of buried sites (TC5-4, NB5-3, SH3-15, LC3-15) and that these locations may be predictable (LC5-3) a testing program should be developed to locate them at the time intensive survey takes place, not during construction. Subsurface testing can also be useful where necessary to determine site boundaries and resource values.

9 It is not clear if historic sites have been adequately dealt with in the draft environmental statement. On page R-2, it is stated that there are numerous important historic sites in the region. Yet, the historic surveys performed for four of the lease blocks did not encounter any historic sites (NB2-18, TC2-13, SH2-23, LC2-15). This inconsistency should be corrected.

State Director, Rock Springs, Wyoming

Given the intensity, variety, and early development of several sectors of engineering and industrial activity in the impact area (R2-50-52), we would suggest that a first step would be completion of HAER inventory cards for all sites in the region. This would provide the context within which to evaluate the relative significance of these sites and thus provide proper direction of mitigation efforts. HAER is willing to either contract to carry out such an inventory or provide training, direction, and review of a Bureau of Land Management effort. The inventory could also include all historic sites if the Bureau of Land Management wished. In any case, the investigative coverage given historic sites in the environmental impact statement is weak and improper; it allows neither evaluative decisions nor informed mitigation.

10

Resource Evaluation

The evaluation of the resources encountered in the survey should be presented in more detail. It is not clear how so many sites, 339(R2-48), were encountered in the survey, yet only 9 were considered for the National Register. One hundred and eighty-five sites were encountered in the Black Butte Area (BB2-25) but only 55 were intensively collected, 40 tested, and none of the sites was nominated or the subject of a determination of eligibility. Thirty-three sites encountered in the South Haystack survey were not recommended for additional testing and the 5 sites tested did not meet National Register criteria (SH2-18). It is not clear if these decisions were based upon a proper understanding of National Register criteria. The Long Canyon project area survey produced 68 sites. Of these one was nominated to the National Register, 23 were recommended for additional testing and no additional work was recommended for 40 sites (LC2-15).

11

All sites encountered during survey must be evaluated against National Register criteria (Executive Order 11593). It seems unlikely that the National Register criteria are being properly applied or adequate testing being performed to provide data needed to interpret site values. Small, shallow and disturbed sites including lithic scatters and other single component surface and subsurface sites (TC2-13, TC3-16) as well as deep, well stratified sites can yield significant information (see "The Importance of Small, Surface, and Disturbed Sites as Sources of Significant Archeological Data," Talmage and Chesler, 1977, an IAS publication).

12

Mitigation of Adverse Effects

Mitigation of adverse effects to cultural resources should take place after all survey and identification work has been satisfactorily completed. This should be done in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and procedures set forth

13

in 36 CFR 800. On page BB1-4 it states that salvage to mitigate adverse effects has taken place. However, there are no archeological sites determined eligible or listed on the National Register (NR) mentioned in this part of the report nor is any mention made of consultation with the Advisory Council on Historic Preservation (ACHP). This does not reflect compliance with Executive Order 11593. Neither is it an approach that is consistent with Federal historic preservation responsibilities.

14 The mitigation measure which suggests monitoring (LC4-1, TC4-1, SH4-1, BB4-1, NB4-1) might be useful as a final backup measure. However, it is not a substitute for adequate survey, identification and testing prior to the commencement of land-modifying activities. Furthermore, it is up to the archeologist performing the survey to recommend the proper treatment of the resources, but not to determine final disposition. If sites of NR quality are found, consultation with the ACHP should be sought in compliance with Section 106 after the NR consultation process has been completed.

15 It is the responsibility of the Bureau of Land Management to deal with project impacts to both historic and prehistoric resources and disturbance to both types of cultural resources should be treated in the same way (R8-4). Adequate provisions to mitigate adverse effects to National Register quality historic sites such as the town of Cumberland, Old Black Butte Mine, Hallville, Gibraltar Mine, Black Butte's Stage Station and the Overland Trail Corridor have not been made. It is not sufficient to list project impact on historic sites (SH3-15, SH5-4, BB3-23A); they should also have a mitigation program.

16 It was difficult to evaluate parts of the sections on cultural resources because there are places where contradictory sentences appear in the same section or paragraph such as SH2-23, BB2-35, and BB3-22-23a.

Finally, the section on Coordination in the Review of the Draft Environmental Statement on Nongovernment Organizations should include the National Trust for Historic Preservation, The Society for American Archeology, the Society for Historical Archeology, American Society for Conservation Archeology and local historical societies.

RECREATION

17 Our comments on recreation focus on the two-sentence summary of recreation impacts, section 3(M), of the DES Summary Sheet.

State Director, Rock Springs, Wyoming

Sentence one reads: "Urban recreation facilities would not meet increased population needs, as outdoor recreation opportunities will decrease." Considering the nature of the region, "primitive" recreation activities dependent upon natural resources have been stressed throughout the analyses; and, as has been adequately pointed out, these will undoubtedly be diminished both in quality and participation opportunity by mining and related development. We share the expressed concern on the inability of urban recreation facilities to meet future demands of increased population, a secondary impact of the proposed action; but this conclusion is based solely on a cursory listing of some general types of developed recreation facilities on page R2-57 of Volume 1. An inventory of existing recreation developments, their location, and their adequacy in meeting present and projected needs would seem to be the minimum information required to assess the severity of secondary impacts.

18 Sentence two of section 3(M) reads: "There would be increased recreation opportunity generated by surface mine development." We fail to understand how a project which would remove "approximately 50,000 acres from the base for recreational use" (page R4-30, Volume 1) would result in "increased recreation opportunity." If this generation of increased recreation opportunities is based upon sightseeing at geological cuts or upon industrial interpretation, we cite our letter of June 3: "While sightseeing opportunities might mitigate nonresident recreational demand to some extent, we believe it should be pointed out that this will have little effect in mitigating the loss of recreation to local residents." In any case, interpretation has not been incorporated into the proposal. We seriously question assigning significant recreational benefits to sightseeing at surface mining sites anywhere in the document and suggest eliminating sentence two, section 3(M), from the Summary Sheet.

NATURAL LANDMARKS

19 There are eight areas in the Uinta-Lincoln-Sweetwater County regional area that have been inventoried, evaluated, and are considered as potential additions to the National Registry of Natural Landmarks. Potential conflict exists between the proposed action and one of these, the Leucite Hills-Boar's Tusk Area.

This rather large area generally lies between R. 101 W. and R. 104 W. and T. 21 N. and T. 23 N. in Sweetwater County, an area that includes at least a portion of the Long Canyon project area. According to the

State Director, Rock Springs, Wyoming

Inventory of Significant Geological Areas in the Wyoming Basin Natural Region, prepared for the National Park Service in 1974, "Boundaries for the area should be determined after on-site evaluation but two possibilities exist. The whole area consisting of approximately 550 square miles could be designated as a natural area or only specific sites of interest such as Steamboat Mountain, the Boar's Tusk, and Pilot Butte could be designated. The latter possibility seems more reasonable in view of the large area involved, private ownership of some areas, and economic interest in some of the less spectacular Leucite Hills." If only specific sites are considered for designation, there may still be a conflict with the Boar's Tusk which appears to be within or near the Long Canyon project area.

The area is partially on lands administered by the Bureau of Land Management's Rock Springs District Office, and they should be able to identify potential conflicts between the Long Canyon project and the resource integrity of the Leucite Hills-Boar's Tusk Area. Continuing integrity of the resource is an essential element in maintenance of the quality of national significance, the test being: does the area still possess, intact, the resource or resources for which national recognition is being considered? We believe that the proximity of the project area to the potential landmark should be recognized, and potential conflicts addressed, in the final document.

ALTERNATIVES

We believe, as stated in our letter of July 27, 1977, that "the discussion of project alternatives in chapter 8 should be strengthened in the . . . southwestern coal region site-specific environmental statements." This could be accomplished by presenting feasible alternatives in project scale. This was done in the North Block project's Hams Fork Protection Alternative which is protective of crucial moose winter range. More representative of the choices afforded in the document is the Black Butte analysis. It proposes a project area of some 36,500 acres from which 146 million tons of coal will be extracted over a 25-year period. We believe that there must be some middle ground between the surface mining of 146 million tons of coal and "no action."

20

The Twin Creek analysis states in its no action alternative that "other coal would have to be acquired to supply these markets (which would be supplied by Twin Creek coal). Such a substitution could create a shortage in supply for other coal markets." Yet, within the same paragraph, we find that "Coal from the Twin Creek Mine is

21

not presently committed to supply specific markets." We do not understand why the no action alternative would create hardships on certain coal markets when no market has yet been identified for the 40 million tons of coal to be mined at the Twin Creek site.

MAPS

We are pleased that our general comments on maps made in early coordination letters, dated June 3, 1977, and July 27, 1977, have been incorporated in this draft. We especially commend the consolidation of large scale regional maps into a separate appendix, unobtrusively making necessary information available to the reviewer without detracting from textual continuity. The site specific surface and mineral status maps also adequately treat our previously expressed concerns regarding the projects' exact locations.

22 One relatively minor discrepancy in the associated text was noted during our review. In Volume 1, page R2-57, "Existing Recreational Developments," the reader is advised to "see Map 11, Appendix A, for [recreational] facilities." Map 11 shows only resources supporting the oft-cited "primitive type of recreation experience," not recreation facilities.

for Robert F. Stewart
Robert J. Arkins

cc: Jan Wilson, State Liaison Officer/State Historic Preservation Officer, Cheyenne, Wyoming

Letter 3 Responses

1. Text revised to reflect review of the Federal Register list of National Register properties (site specifics, Chapter 2s, Cultural Resources). Consultation with the Advisory Council and the State Historic Preservation Officer had not been completed by the time the draft ES was printed.

2. Mitigation of adverse effects upon both historic and archeological sites has been assessed in consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer in compliance with Section 106 of the Historic Preservation Act of 1966.

3. The basic resource documentation is available from Western Wyoming College, Rock Springs, Wyoming, and the University of Wyoming, Laramie, Wyoming, but is not available for distribution or review from BLM offices.

4. All historic properties within the project areas were identified. Hallville Mine and Townsite, Gibraltar Mine and Townsite, Black Butte Stage Station, and Cumberland Townsite were all determined to be eligible for inclusion on the National Register. Preliminary case reports have been prepared in compliance with Section 106 procedures. They have been commented on by the State Historic Preservation Officer and submitted to the Advisory Council.

5. The 106 compliance case reports have been filed. Consultation with the State Historic Preservation Officer has been conducted.

6. Research design and theoretical framework are not presented in the ES. Such data are contained in the survey reports referenced in the ES. Surveys must meet minimum standards of a Class III inventory, as defined in BLM Manual 8111.14. Evaluations of all cultural resources are based upon 36 CFR 800.10 (National Register Criteria); the ES is a summary of this procedure.

7. Both issues are dealt with in North Block and Twin Creek, Chapter 4.

8. The site specifics, Chapter 4, include such programs which are now being carried out in the North Block and South Haystack project areas.

9. While there are many historic sites within the region, comprehensive historic surveys reveal no historic sites within four of the project areas. Historic sites have, however, been identified within the Black Butte project area.

10. Should there eventually be effects to the historic properties, Historic American Engineering Record recordation, as well as Historic American Buildings Survey documentation of the structures involved, will be considered. Avoidance is the mitigation proposed for all properties eligible for the National Register of Historic Places in or near lease boundaries.

11. All cultural resource surveys were conducted by experts in Wyoming archeology and history who are familiar with National Register criteria. The absence of National Register sites or of those eligible for the National Register within the project areas is not surprising in the perspective of the regional prehistory.

12. Scientific data can and have been retrieved from cultural deposits encountered in surveys. In many cases, data retrieved for purposes of evaluation eliminated the site.

13. Consultation is currently being conducted. Inventories have been and will be conducted in compliance with section 2(b) of Executive Order 11593.

14. The mitigation measures in the site specifics, Chapter 4, are to be carried out before surface disturbances. Surface reconnaisance will be completed prior to surface disturbance. Subsurface evaluation will be completed prior to mining. Consultation with the Advisory Council and State Historic Preservation Officer and compliance with Section 106 will be conducted where necessary.

15. Text revised (Long Canyon, South Haystack, and Black Butte, Chapter 4).

16. Text revised (South Haystack, Chapter 2, and Black Butte, Chapters 2 and 3).

17. The Summary has been revised. A list of recreational facilities, size, and capacity has been added to the Regional, Chapter 2, Recreational Resources section.

18. The Summary has been revised.

19. The BLM, through its planning system, has identified only part of this area as a potential natural area. This is in the sand dunes area north of the Boar's Tusk at about T. 24 N., R. 104 W. (outside of the ES region).

The Green River Resource Area staff of the BLM's Rock Springs District is currently drafting a management plan for the Sand Dunes Complex which should be finalized in FY 79. When this plan is implemented, the area will be managed to prevent impacts created by the increased recreational use due to the possible increased population from the proposed actions.

20. In the selection of an alternative to the proposed actions, several types are possible. The one suggested in the comment for Black Butte is a way to accomplish such a selection. Rather than attempt to preselect a production rate somewhere between "no action" and the maximum production for each proposed mine site or take a similar approach for the amount of acres disturbed, this ES selected an approach which developed two scenarios (low and high) using a total production rate as the criteria for identifying the scenarios. The mid-level production rate in this case is the proposed actions. The Hams Fork Protection Alternative was developed due to the identification of impacts during the analysis of the mining and reclamation plans on file with the USGS. This method of development of alternatives was used in the assessment of each mining and reclamation plan and, where deemed necessary, alternatives were prepared. An additional alternative has been prepared for the Regional for consideration by the Secretary of the Interior. This alternative, Defer Federal Action, was developed through comments as a result of public review, which is another approach that can be taken for selection of a type of alternative. While the approach to alternatives suggested in the comment was considered at an early stage of preparation of the draft ES, it was rejected in favor of the scenarios and alternatives presented in the draft and final ESs.

21. Text revised (Twin Creek, Chapter 8, No Action).

22. Text revised (Regional, Chapter 2, Recreational Resources).

4

United States Department of the Interior

NATIONAL PARK SERVICE

Fossil Butte National Monument
P.O. Box 527
Kemmerer, Wyoming 83101

IN REPLY REFER TO:
A94-1

June 2, 1978

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, WY 82901

Dear Sir:

The North Block and Twin Creeks proposed mine development sites are approximately five miles from Fossil Butte National Monument. These sites are blocked from view by a mountain range within the five miles buffer zone. We do not believe there will be any environmental impact beyond possible siting of dust from Fossil Butte National Monument.

Sincerely,

David L. Olson

DAVID L. OLSON
Acting Superintendent

5

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

324 25th Street
Ogden, Utah 84401

1950

Mr. Francis Eikbush
Team Leader
Southwestern Wyoming Coal ES Team
P.O. Box 1869
Rock Springs, Wyoming 82901

Dear Mr. Eikbush:

Enclosed are our comments concerning your draft EIS for Development of Coal Resources in Southwestern Wyoming. These are keyed to the chapter and page within the chapter.

We appreciate the opportunity to comment on your draft statement. If you need help in obtaining additional information, contact the Forest Supervisors:

Ashley N.F. - Vernal, Utah
Robert Rowen, Forest Supervisor
789-1181

Bridger-Teton N.F. - Jackson, Wyoming
Reed Jackson, Forest Supervisor
733-2752

Wasatch N.F. - Salt Lake City, Utah
Chandler St. John, Forest Supervisor
588-5034

If we can be of help, please call me in Ogden.

Sincerely,

P. M. REES
Director
Regional Planning and Budget

Enclosure

5

U.S. FOREST SERVICE - REGION FOUR

Comments regarding Draft Environmental Statement on Development

of Coal Resources in Southwestern Wyoming

Dated April 7, 1978

Volume I

Summary - Item 3.M. - Speaks to increased recreation opportunity generated by surface mine development. We believe this statement should read: "There will be increased recreational activity of all types demanded by the larger population resulting from surface mine development. This will be on adjacent National Forest lands, both in and outside the EIS region."

- Summary should include breakdown of land ownership - State - BLM - Forest Service etc.

Chapter 2 - R2 - 23 - Description of Environment Topography - Needs statement regarding elevational differences within Region.

1 26 - Soils - Discussion does not relate to soils found on National Forest lands which are not "generally sparsely vegetated." Reading the vegetation section, as suggested for amount of vegetation, gives no indication of soil productivity; figures for productivity are not given.

2 41 - Endangered and (or) Threatened - Other species that should be listed include:

Haplopappus contractus - thought to be extinct. Known only from one species collected at Ft. Bridger, Wyoming. (A Bureau of Land Management report erroneously says this species is no longer on proposed Federal list).

Arabis demissa var. russeola - is found in Sweetwater County on Flaming Gorge NRA.

3 41 - Fish and Wildlife Habitat types - Include conifer, meadow, aspen, and cropland as habitat types for terrestrial wildlife species - Also species using these habitats.

Grassland - No mention of birds.

Mountain Shrub - No mention of birds.

Raptors - Data very slim as to be almost non-existent.

Vegetative types need to correspond with map #7 in Appendix A.

42 - Wildlife - Introduction - Primary habitat types must include aspen and conifer. These are vital for big game species.

Birds - Nongame - Data lacking. At least list species. Same with raptors or refer to Table R2-17 if this is a complete listing.

Endangered and (or) Threatened - states "Area poor habitat and chance of nesting remote." From what source or documentation is this statement made?

45 - Mammals - Nongame - Incomplete listing.

46 - Table R2 - 20 - Table states "Acres of habitat occupied during season of use." Change habitat to range.

52 - Visual Resources - Apparently the Bureau of Land Management land classes do not take into consideration mountainous areas. None of the classes discussed include areas of conifers and aspen found on National Forests within the Region.

57 - Recreation Resources - General Comments - The evaluation of existing recreational resources is inadequate, especially as related to those on National Forest lands. This is especially true of Flaming Gorge National Recreation Area.

Specialized: No data is presented about dispersed recreation use, opportunities, or future demand. Rock hounding, exploring historical sites are two examples.

Data from the Upper Green River Basin study completed by the Bureau of Land Management - Forest Service and others can be used to broaden the recreation writeup.

Inadequate consideration is given to off-road vehicle impacts. Needs to be projections of numbers and use areas, impacts on land, wildlife and other conflicts. Heavy off-road vehicle use results from population increases as a result of mining and construction.

Increased recreation facilities will be needed, such as campgrounds, picnic areas, and sanitation facilities. There must be some discussion of the amount, cost, and location of these facilities. It can be anticipated that much of the increase in recreation will be on National Forest lands, as they are generally the closest mountain area, both in and outside the EIS region.

Sightseeing - No reference to this on National Forest lands - clearly this is done on the Flaming Gorge NRA as well as the portion of the Wasatch National Forest within the EIS region.

11 Potential Wilderness Study Areas - The Forest Service RARE II study and areas designated for consideration as wilderness study areas is available. This data should be made a part of the EIS.

12 61 - Livestock grazing - Nothing said about livestock grazing on National Forest lands. No grazing figures for Wasatch National Forest within EIS region.

13 61 - Forest Resources - No mention of National Forest resources. Other parts of environmental description state reasons for no coal mining, but why not here? List resources available (and there are many) on National Forest lands. North slope of Uinta Mountains timber resources can be used for construction.

14 63 - Socio - Economic Conditions - Projected population figures from recent Abt Associates contract are extremely conservative. No consideration is given to secondary recreational impacts on National Forest, Bureau of Land Management or other lands which are adjacent to population centers.

15 98 - Visual Resources - Very inadequate as regarding National Forest lands.

16 98 - Other - Should discuss what will happen through MORE positive management. The impression is given that recreational impacts and activities will just "happen" and cause problems.

99 - Table R2-52 - We believe your "General" category must be broken down further. You cannot combine camping and picnicking with sightseeing, etc. This gives a distorted view and a planner would be hard pressed to determine how many sites he should be providing in the future if camping, picnicking, sightseeing, etc. are combined. We have found throughout the Forest Service that sightseeing is the greatest single reason people go out to National Forests. It should therefore stand on its own.

Chapter 3 - Planning and Environmental Controls

17 4 - Land Use Plans, Controls, and Constraints - Ashley National Forest is also included in EIS Region.

Chapter 4 - Impact Analysis

18 16 - Table R4-4 - Consider water use and withdrawal for recreational and wildlife use. While this may not be large, it needs to be listed.

19 26 - Wildlife - No consideration of effect of or reduction of small birds and mammals.

30 - Recreation Resources - We do not agree that the typical type of recreation involves people traveling to find solitude. True, they prefer solitude, but they are there to do something. If the desired activity can no longer be enjoyed due to project development or other people, then a conflict arises.

20 Under the heading of hunting, fishing, and sightseeing, there is NO mention nor analysis of impacts on National Forest lands and resources from increased population.

30 - Specialized Activities

Off-Road Vehicles - Section needs rewording. More roads offer opportunities to the sightseers but not necessarily to the off-road vehicle occupant.

31 - Table R4-10 - Break out camping and picnicking from sightseeing.

21 32 - Livestock Grazing - Question the flat statement about restoration of grazing capacity after reclamation.

22 32 - Existing Recreation Developments - Must have consideration of impacts on adjoining National Forest lands as these will be significant. This has already been proven at Flaming Gorge with growth of Green River - Rock Springs Area. Also emphasize requirement for recreation management.

Chapter 7 - Any Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Actions Should They be Implemented - Add "overcrowding of recreational facilities."

Chapter 8 - Alternatives to Proposed Actions

Page 4 - Recreational Resources - Increased use will not necessarily reduce quality of recreation experience if it is "managed." Areas with wilderness values that are managed as such will experience a long-term increase in use, especially if formally designated.

Page 5 & 16 - Impacts of Low-Level Scenario - Do not mix camping and picnicking with sightseeing.

Appendix A - Maps

23 Map 10 - Visual Resources - As stated in the comments regarding Volume I, we do not agree with the clarification of visual resource, especially on National Forest lands. A landscape architect could certainly come up with better than this.

24 Map 11 - Recreation and Land Use - In the legend, next to the green block, please include National Forests. Show - recreation areas, campgrounds, etc.

25 Map 13 - Transportation Networks - Continue road up Smith's Fork on Wasatch National Forest.

Letter 5 Responses

1. Areas not to be directly impacted by the proposed actions were not discussed in detail. The average vegetative cover and production of the region is low when compared to other areas of the United States which receive greater precipitation. Text revised in reference to second sentence of comment (Chapter 2s, Soils).

2. Text revised (Regional, Chapter 2, Vegetation, Endangered and (or) Threatened).

3. Only habitat types that would be directly impacted by mining or are adjacent to disturbance and may be adversely affected were included in the discussion. It is agreed that bird species should be included in grassland and mountain shrub habitat types. See additions in text (Regional, Chapter 2, Fish and Wildlife, Habitat Types). See Regional, Chapter 2, Birds, Nongame, for a more detailed discussion of raptors. Vegetation types were taken from the same information source that was used to develop the map.

4. Only habitat types that would be directly impacted by mining or are adjacent to disturbance and may be adversely affected were included in the discussion.

5. Text revised to add forested areas (Regional, Chapter 2, Visual Resources, Class II).

6. The demand on recreational resources on National Forest lands was assessed by using data in the Green River Basin Study combined with other data on lands within the region. A table showing recreational facilities has been included (Regional, Chapter 2, Recreational Resources, Existing Facilities) in the final ES.

7. The numbers for these types of activities are combined in their general categories in the analyses. Such examples as swimming, waterskiing, and boating are in the "Water sports" activity category; rock hounding, camping, and picnicking are in the "General" category.

8. Estimated numbers have been added to the ES. Impacts to other resources are handled in those sections where that specialist felt there was need.

9. These comments are covered in the Regional, Chapter 4, Recreational Resources, Existing Recreational Developments section.

10. Sightseeing use on National Forest lands was assessed by using the data in the Green River Basin Study and combining the data with other data on lands within the region.

11. Review of the Forest Service, Wyoming, map on the RARE II study showed that no areas under consideration as wilderness study areas were in the ES region; therefore, data were not included in the ES.

12. Text revised (Regional, Chapter 2, Agriculture, Livestock Grazing).

13. Only resources that would be directly impacted by mining or are adjacent to disturbance and may be adversely affected were included in the discussion.

14. Recent analytic modeling, based upon the latest information available (1978), indicates that the figures shown in the final ES are reasonably accurate.

Recreational impacts are covered in the Recreational Resources sections of the final ES.

15. After reevaluation of the statement and consultation with U.S. Forest Service personnel stationed at the Ashley, Wasatch, and Bridger-Teton National Forests, it is felt the visual evaluation is adequate.

16. The Chapter 2, Future Environment, descriptions have been reformated.

17. Text revised (Regional, Chapter 3).

18. This amount is quite small. Only items that were impacted were considered. The ES team Wildlife Biologist has estimated that the entire big game herd (antelope, deer, elk, and moose) uses as much as 100 acre-feet of water per year.

19. See additions in text (Regional, Chapter 4, and site-specifics, Chapter 3, Fish and Wildlife, Birds, Nongame, and Mammals, Nongame.

20. Estimated numbers and impacts to National Forest lands due to increased population were assessed by using the data in the Green River Basin Study combined with other data on recreation within the region.

21. It is believed, based on reclamation research results in the arid southwestern United States and reclamation/plant species succession results in the ES region, that reclaimed mined areas would be capable of supporting premining livestock numbers. Generally, the plant species seeded and (or) planted on mined areas would be more palatable to livestock than at least some of the plant species existing prior to mining. Appropriate grazing management systems would need to be used for reclaimed areas to prevent overgrazing.

22. The impacts to National Forest lands due to increased population were assessed by using the data in the Green River Basin Study combined with other data on lands within the region.

23. After reevaluation and consultation with U.S. Forest Service personnel stationed at the Ashley, Wasatch, and Bridger-Teton National Forests, it is felt the visual classes are adequate.

24. Change was made to legend in the draft ES by use of an errata sheet. It was felt that recreation areas, campgrounds, etc., were not needed on the map for analysis of impacts.

25. This county road would not be impacted by the proposed actions and is not considered significant enough to be put on the map.

6

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE- P.O. Box 2890

Washington, D. C. ~~20250~~ 20013

1979

Team Leader
Coal ES Team
P.O. Box 1869
Rock Springs, Wyoming 82901

Dear Team Leader:

This is in response to your recent request for our review and comment on the Southwestern Coal Region of Wyoming draft environmental statement.

The document provides considerable information for utilization in decisionmaking. To further enhance use of this information, however, it is recommended that an executive summary be provided that summarizes pertinent material in a succinct manner.

1 Throughout the text it is stated that data are lacking with which to determine if coal related or other activities would effect prime farmlands. It should be recognized, however, that in accordance with the Surface Mining Control and Reclamation Act of 1977 (PL-95-87), specific standards for identification and reclamation of prime farmlands are mandated.

Sincerely,

Edward E. Thomas
Acting Assistant Administrator
for Land Resources

Letter 6 Response

1. See Regional, Chapters 2 and 4, Agriculture, Prime Farmland. Text revised (Regional, Chapter 8, Agriculture, Prime Farmland, Low-Level and High-Level scenarios). It is unknown where oil/gas exploration and development will occur. Such activities could disturb identified prime farmlands, and special reclamation practices would be used through other BLM procedures.

7

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. Box 2440, Casper, WY 82602

June 1, 1978

Team Leader
Coal ES Team
Bureau of Land Management
U. S. Department of Interior
P. O. Box 1869
Rock Springs, WY 82901

Dear Sir:

We have reviewed the Draft Environmental Statement for Development of Coal Resources in Southwestern Wyoming. The report gives a detailed picture of the existing environmental setting and display of the environmental impacts of the proposed actions.

The only specific comments we have to offer are as follows:

Page R2-61 and R2-98, Agriculture - We feel this report is rather brief in discussing the irrigated lands that exist in the area. You use sub-headings of "Livestock Grazing" and "Prime Farmlands" in this section. We believe that sub-headings of "Rangeland" and "Cropland" would be more appropriate.

1 Page R2-97, Table R2-51, Estimated Water Withdrawal in 1980, 1985 and 1990 Without the Proposed Action - You list 1,210,000 acre feet of withdrawal for irrigation in this and other tables in the report. This appears to be excessive for the study area. Actually it is difficult to evaluate in that you do not show the acres irrigated for the study area. If one assumes that all of the acres listed as prime farmlands on page R2-61 are irrigated, we would have a withdrawal of more than ten (10) acre feet per acre. A definition of what is meant by water withdrawal would be helpful. Do you mean water diversions or consumptive use? There is a wide range between the two amounts with the 1,210,000 acre feet appearing to be excessive even for water diversions.

Thank you for the opportunity to review this statement. Please advise if we can be of any further assistance.

Sincerely,

Frank Dickson

Frank S. Dickson
State Conservationist

cc: R. M. Davis, Administrator, SCS
Environmental Protection Agency (5)
K. L Williams, Director, WTSC, SCS

Letter 7 Response

1. Withdrawals for irrigation were obtained from data collected by the USGS for Water Resources Council (WRC) Regions in Wyoming for the year 1975. They list 33,700 acres irrigated in 1975 in WRC Region 1401, which includes most of the southwestern Wyoming ES region. Withdrawal is the total amount of water diverted or pumped from a stream or an aquifer for a specific purpose.

8

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230
(202) 377-~~3111~~ 4335

May 31, 1978

Team Leader
Coal ES Team
P.O. Box 1869
Rock Springs, WY 82901

Dear Sir:

This is in reference to your draft environmental impact statement entitled, "Development of Coal Resources in Southwestern Wyoming." The enclosed comments from the National Oceanic and Atmospheric Administration (NOAA) are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving five copies of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure: Memo from: Douglas LeComte
Environmental Data Service
NOAA

8

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL DATA SERVICE
Washington, D.C. 20235

May 12, 1978

MAY 18 1978

TO: William Aron
Office of Ecology and Environmental Conservation

FROM: Douglas LeComte
Special Projects

SUBJECT: DEIS 7804.06 - Development of Coal Resources in Southwestern Wyoming

General

The description of the climate is unusually comprehensive and complete. However, there are a few relatively minor comments that should be made regarding specific statements.

Specific

Page R2-1, Surface Temperature: "46°F" should read "-46°F."

1 Page R2-5, Relative Humidity: An average daily variation of 9% in January seems improbably low. This figure should be checked.

2 Page R2-11, Droughts: This paragraph defines "dry spell" but does not define "drought." The statistics on droughts, therefore, are not meaningful.

3 Page R2-11, High Winds: This paragraph should give some idea of the frequency of the stated wind speeds.

4 Page R2-11, Frequency of Wind Direction and Speed in Uinta and Lincoln Counties: The wind speeds at Fort Bridger seem very high. Perhaps the wind recording instruments are especially high off the ground, making the wind readings not representative of the region. The generally accepted standard is a height of 10 meters above the ground.

Letter 8 Responses

1. The figure has been checked and found to be correct.

2. Text revised (Regional, Chapter 2, Climate, Severe Weather Events).

3. The figure to which the reader is referred in this same paragraph shows the frequency of the wind speeds.

4. The wind speeds as given for Fort Bridger have been checked and found to be correct.

9

Department of Energy
Washington, D.C. 20545

MAY 31 1978

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, WY 82901

Dear Sir:

This is in response to your transmittal dated April 11, 1978 in which you invited the Department of Energy (DOE) to review and comment on the Department of the Interior, Bureau of Land Management's draft environmental impact statement for the South Western Coal Region of Wyoming.

We have reviewed the statement and have determined that the proposed action will not conflict with current or known future DOE programs. Staff comments are enclosed, which you may wish to consider in the preparation of the final statement.

Thank you for the opportunity to review and comment on the draft statement.

Sincerely,

W. H. Pennington, Director
Division of Program Review and Coordination
Office of NEPA Affairs

Enclosure:
DOE Staff Comments

DOE STAFF COMMENTS
U.S. DEPARTMENT OF THE INTERIOR/BUREAU OF LAND MANAGEMENT
DRAFT ENVIRONMENTAL IMPACT STATEMENT
SOUTH WESTERN COAL REGION OF WYOMING

1 It is suggested that some assessments should be given in the areas of health, occupational safety and accidents and other risks associated with the proposed actions.

2 Secondary or indirect, as well as primary or direct, consequences for the environment should be improved in the analysis. Five site specific mines that are proposed for development in Southwestern Wyoming could significantly induce secondary effects in the form of changed patterns of social economic activities. In discussing population and growth characteristics of the affected area, DOI should give consideration to using the rates of growth in the region of the project contained in the projection compiled for the Water Resources Council by the Bureau of Economic Analysis of the Department of Commerce and the Economic Research Service of the Department of Agriculture (the OBERS projection).

3 The boom-town phenomenon and mitigation strategies of the proposed action have not been adequately addressed in the draft EIS. According to a study entitled, "Compilation of Key Issues Related to the Productivity and Occupational Health/Safety Implications of Eastern and Western Coal Mining" by Systems Consultants Inc. for ERDA on August 16, 1977, it was pointed out, in the study, that in Sweetwater County in Southwestern Wyoming the population tripled between 1970 and 1975. The population there is growing at a compound annual rate of 19 percent. Sparsely populated counties like Sweetwater can absorb a growth rate of only 5 percent without serious socioeconomic troubles. Now Sweetwater County has the third highest per capita suicide rate in the Nation. In what is termed the "Gillette Syndrome" equal parts of alcoholism, accidents, absenteeism, depression, divorce, and delinquency thrive.

4 In Volume 2, Chapter 4 (Mitigating Measures not Included in the Proposed Action) should include the following statements.

The state government has identified several remedies including the infusion of additional revenues to local units of government, the provision of information and technical assistance, and the introduction of state and local influence into the siting of energy facilities. Efforts to increase local revenues have included automatic increase in the distribution of state tax receipts, legislated increases in the distribution of the sales tax, Joint Powers loans, coal impact tax grants, and the enactment of an optional sales tax. The state has tried to provide information and technical assistance to local governments through the Department of Economic Planning and Development and the Industrial Development Information and Siting Act. The principal tool for controlling energy development is now the Industrial Siting Act.

Taken as a whole, these actions respond reasonably well to the problems currently plaguing energy-impacted communities in Wyoming. The State has attempted to cope with the problems of inadequate front-end revenues, a lack of local expertise and a lack of state and local control over energy company decisionmaking. While there may be weaknesses or administrative difficulties in the current set of policies, the steps Wyoming has taken should serve to meet the goal of orderly energy development. To the extent the State wishes to assume the responsibility for compensating parties adversely affected by energy development, existing laws might be modified to target funds more directly to those actually harmed.

5 The discussions of water resources in the sections on the existing environment, the future environment without the proposed action, and the impacts of the proposed action, need to be expanded to include a more complete assessment of the impacts on available water supplies. Nowhere are the available surface and groundwater resources estimated, nor is it clear whether water availability will be a constraint to the proposed future developments.

In addition, the section on the description of the future environment without the proposed action is actually the same thing as the impacts of the no action alternative. This relationship should be clearly stated, and discussion of these impacts need only be discussed in one section of the document. When discussing the incremental impacts of the proposed action and comparing these impacts to those without the proposed action, reference can be made to the impacts associated with the no action alternative.

Comments of a more specific nature and some editorial comments are discussed below. Many of the comments made on volume 1, the regional analysis also apply to the related sections in the site-specific analyses, for the organization of and much of the information in the two volumes are the same. For purposes of efficiency, many of these comments were not repeated for the site-specific analyses.

Specific Comments on Regional Analysis, Volume 1:

Summary

Estimated impacts (eg., population increase, vegetation disturbed, wildlife habitat adversely affected, reduction in livestock and wildlife forage, etc.) are too exact. These impacts are only estimates and therefore should be rounded off to reflect some degree of uncertainty.

P. R1-9, Water Developments, right column, 13th line

Spacing - "acre feet per year."

P. R1-10, Table R1-3

Change "Tons of coal mined (millions)" to "Tons of coal mined annually (millions)."

P. R1-13, Assumption 5

6 Nine years (5 years to establish vegetation) to reclaim mined lands seems very optimistic. Is the reclamation potential of the soils very good throughout the area to be disturbed?

P. R2-16 and RB-1 & RB-3, Air Quality Standards and Regulations

7 The discussion of PSD increments and Class I, II, and III areas should be further clarified: a) Allowable PSD air quality increments are set to regulate incremental increases of TSP and SO_2 from new sources in regions currently attaining ambient air quality standards. The allowable PSD air quality increments represent the maximum increase in pollutant concentrations allowable over and above existing baseline ambient levels. b) For all PSD Classes, air quality deterioration would be permitted as long as neither the applicable PSD air increment nor the secondary NAAQS is exceeded.

P. R2-34, left column, line 25

"semiconfirmed" should be "semiconfined"

P. R2-34, left column, 2nd full paragraph, line 2

"oF" should "of"

P. R2-37, Surface Water

8 Include discussion of the availability of surface water resources. Are surface water supplies scarce? Is there sufficient water available for new uses (e.g., expanded energy or industry development)?

P. R2-62, Table R2-26

Under "Subbituminous" column for Henry's Fork Field "F1" does not make sense.

P. R2-93, Air Quality, left column, last sentence of first paragraph

9 Mention how the second highest 24-hour background TSP levels relate to the ambient standard.

P. R2-93, Air Quality, right column, second full paragraph

10 How is this increase in NO_x likely to affect ambient NO_x concentrations? Will standards be violated in industrialized areas?

P. R2-96, Paleontology, 3rd line

This should read, "level of regional development . . . "

P. R2-96, Water Resources, Groundwater, last sentence.

11 What is the basis for this statement, "Continued coal mining in private and State properties and on Federal leases that have approved mining plans would have insignificant, localized effects on groundwater availability." Do these mining activities currently have insignificant, localized effects, and if so, are future mining activities expected to be very similar? Is dewatering of aquifers necessary to conduct mining operations? If so, excessive dewatering could have significant local and possibly more widely spread effects on groundwater availability and related surface resources.

P. R2-96, Water Resources, Surface Water

12 Are existing surface water supplies expected to be adequate to meet the increased demand for public water supply? This point deserves more discussion, for most surface water supplies probably already are allocated by law for specific uses.

P. R2-96. Water Use

13 Are the projected water withdrawals from surface water resources? How will these projected withdrawals affect water supplies and quality and how do they compare to existing withdrawals?

P. R2-97, Table R2-51, Estimated Water Withdrawal...

14 What is the basis for these numbers - Table R1-3 and R1-4? The basis should be stated. How will these estimated withdrawals affect water availability? Is a water shortage likely, possible, or unlikely?

P. R2-97, Vegetation, Fish and Wildlife

15 The actual numbers for acreage disturbed and animals lost have little meaning unless compared to the existing environment. Will the projected losses of acreage and wildlife have a significant impact on the ecology of the region? The expected impact would be expressed as the percentage of the existing resources which are lost.

16 P. R2-98, 1st sentence

What does section 106 refer to? Section 106 of what law, guideline, etc.?

P. R2-98, Fishing

This kind of comparison of expected impacts with estimated carrying capacity of the region is very useful. It puts the expected impacts into perspective.

P. R2-98, Hunting

17 How does the projected number of visitor days compare to what the region can tolerate without resulting in adverse impacts on wildlife populations?

18 P. R2-98, Mineral Resources

Some mention of possible oil shale development should be made.

P. R2-99, Table R2-52

To clarify, punctuate title as follows: "SOUTHWESTERN WYOMING REGION, RESIDENT VISITOR USE ESTIMATES FOR 1976, 1980, 1985, AND 1990 BASED ON ESTIMATED POPULATIONS OF: 57,691 FOR 1976; 68,186 FOR 1980; 72,812 FOR 1985; AND 73,543 FOR 1990.

19 P. R2-110, Housing

How severe an impact will the projected increase in housing units have on the communities?

P. R3-2, left column, 1st paragraph, 3rd sentence

Standards were put into effect for TSP, SO_2, NO_x, O_x, and CO. Only guidelines were set for HC.

20 P. R3-2, Solid Waste Disposal

The discussion is incomplete; the Resource Conservation and Recovery Act (RCRA) should be mentioned.

21 P. R3-2, Land Quality

The Surface Mining Control and Reclamation Act, Federal Land Policy and Management Act, and Wilderness Act should also be included in this section.

P. R3-4, right column, 5th line

"gassification" has only one "s".

P. R3-5, Institutional Relationships

22 There should be discussion of the relationship of the proposed action to any water use plans for the region and interaction with any State or regional water planning agency.

P. R4-1, Emissions

"Particulate Emissions" would be a more appropriate title for this section.

P. R4-1, Emmission, 1st paragraph

Blasting is another source of suspended particulate emissions.

P. R4-3, Model Predictions of Worst-Case 24-Hour Impact in TSP Concentrations, Lines 14 - 18

23 The total particulate concentrations of 48 to 83 ug/m^3 are not below the 50 ug/m^3 NAAQS and Wyoming standard for the range of 50 to 83 ug/m^3.

P. R4-8, left column, 2nd paragraph

This discussion of the impacts from blasting and coal fires seems out of place here; it would be more appropriate as the last paragraph of the Emissions section on P R4-1.

P. R4-15, left column, 2nd complete paragraph, line 6

Insert "hydraulic" before the word "head" to clarify.

P. R4-15 and R4-18, Surface Water

24 There is no discussion of the impacts projected water use will have on available surface water supplies. How much available surface water is there? What impact will the estimated water withdrawals in Table R4-4 have on surface water supplies and quality?

P. R4-18, Surface Water Quality

25 Disruption of aquifers which feed surface streams may also reduce water quality by decreasing groundwater flow to the streams which will in turn result in lower stream flows and higher concentrations of dissolved solids or pollutants.

P. R4-25, left column, line 9

Shouldn't "of this area in influence" read, "in this area of influence."

P. R4-25, right column, Calculation of Losses, line 8

"+" sign missing; should read "33,500 offspring + 5,000 individuals originally lost = ".

P. R4-25, Fishery, last sentence of 1st paragraph

Punctuate to clarify as follows: "Fish populations would be impacted by increased sedimentation from off-road vehicle use, decreased streamflows and reservior levels from increased use of water, and increased recreational use such as fishing."

P. R4-25 and 26, Fishery, Game and Nongame

26 Impacts of sedimentation on game fish are estimated over 10 miles of stream while impacts on nongame fish are estimated over 50 miles of stream. Is there any reason for this inconsistency? If anything, game fish would be expected to be affected over a larger distance, because they are usually more sensitive to ecological changes than are nongame fish.

P. R4-28, Historical, 4th line

"is" should be "are."

P. R4-28, Visual Resources, 2nd paragraph, 1st sentence, 2nd line

Place a comma between "Federal" and "State."

P. R4-37, Lincoln County, next to last line

"communities" should be either "community's" or "communities'".

P. R4-43, Infrastructure, Private Sector, 2nd sentence

27 If $147.3 million is a 46% increase in retail sales, $160.1 million can not also be a 46% increase. Does the percentage represent the increase in retail sales over the 1975 level?

P. R6-1, Chapter 6, Short Term Uses/Long Term Productivity

Under effects of mining in long-term productivity, disruption of aquifers and potential associated impacts on stream flow and quality, springs, and seeps should be included.Also, the reduction in soil productivity is not necessarily a short term impact. This is highly dependent upon the success
28 of revegetation efforts in the fragile, semi-arid environment of the study region. Under favorable conditions, only 10 years or so may be required to return the land to a level of productivity similar to that prior to mining, however, as evidenced in Table R2-12, the majority of soils in the ES region have only fair to poor reclamation potential which may require from 15 to 60 or 100 years to return to productivity. Reclamation of lands in semi-arid regions is still under study and many problems still remain to be solved.

P. R8-1, Chapter 8, Alternatives to the Proposed Action

It is not at all clear how the No-Action alternative and Low-Level scenario differ from the Description of the Future Environment without the Proposed Action. Logically, the Description of the Future Environment without the Proposed Action and the No-Action alternative are the same thing.
29 Why do the estimates of soil surface disturbed vary for the two sections - P. R2-96 vs P R8-1? The Descirption of the Future Environment without the Proposed Action and the No-Action/Low Level Scenario in Chapter 8 should be combined and presented only in Chapter 8. The discussion of impacts of the proposed action in Chapter 4 should refer to Chapter 8 for more details when impacts of the proposed action are compared with the impacts without the proposed action.

P. R8-8, Water Resources

What is the basis for the last sentence? Nowhere in the document is the quantity of available water estimated. Will the No-Action alternative
30 or the additional 6.54% increase in water requirements of the High-Level Scenario above the No-Action alternative have an impact on available water supplies in SW Wyoming? It is stated earlier that available water is scarce in the region. The last statement on this page warrants more substantiation.

P. R8-21 and R8-22, Table R8-10

31 A summary discussion of this table is needed as well as explanation of the notations: NA,V and NC.

P. RB-1, RB-17, Appendix B, Supporting Data

32 The text beginning with Air Quality on P. RB-1 through Visibility Related to Ambient TSP Levels on P. RB-17 is the same as the text on P. R2-11 through R2-19 in the Description of the Environment in Chapter 2. Repetition of this section in Appendix B is not necessary. The tables in Appendix B which are not presented in Chapter 2 should remain in Appendix B and should be referenced in the appropriate locations in Chapter 2.

P. RB-17, Soils

33 An estimate of the percentage of the area to be disturbed which was good, fair and poor reclamation potentials would be very helpful.

Specific Comments - Site Specific Analysis, Volume 2:

P. NB 1-1, Predisturbance Inventories and Analyses, 3rd paragraph, 1st line

"on" should be "an."

P. NB 2-8, Groundwater, 2nd paragraph, last sentence

34 Clarify: "4 miles south" of what were the test holes dug? More information on groundwater resource potential should be included as was done for Twin Creek.

P. NB 2-8, Groundwater

35 Include some discussion of the implications the water quality data in Table NB2-3 have on groundwater quality. For what uses would this water be suitable? Is there any data on the groundwater resource potential of this area?

P. NB 2-23, Land Use Plans, Controls, and Constraints, 2nd paragraph, 1st sentence

36 More explanation is needed for which agencies "these agencies" refers to; BLM is the only one mentioned.

P. NB 2-15, Wildlife

The Introduction is not necessary; the information is presented on P. NB 2-8 under Terrestrial Vegetation.

P. NB 3-13, Water Use

37 What impact will the estimated water use have on existing supplies of available water?

P. NB 3-18, Fish and Wildlife Population Loss, Calculations, 3rd line

"ming" should be "mine."

P. NB 3-18 and TC 3-15, Fish and Wildlife Population-Loss, Calculations, 3rd line

Should this read: "20 year mine life ÷ the number of times the population would turn over in 20 years?"

Calculations, line 9 "+" sign is missing.

P. NB 3-20, Summary of Table NB 3-7

"NB 3-7" in the above title should read "NB 3-5."

P. TC 1-13, Reclamation Schedule, last sentence

Should this read: "Table TC 1-5 shows the sequence of disturbed lands by area and the time schedule for reclamation?"

P. TC 1-20, Pollution Control Methods, point #1

Should read: "1. Coal storage would be in closed silos."

P. TC 1-21, Wyoming Highway Department, 2nd line

"form" should be "from."

P. TC 2-3, Figure TC 2-1

"Eolene" in the left most column of the stratigraphic column should be "Eocene."

P. TC 2-12, Wildlife

Delete Introduction - this information is covered under Habitat types on the same page.

P. TC 2-14, Correct Spacing in title of Figure TC 2-4

Figure "TC 2=5" should read "TC 2-5." Figure TC 2-5 - should 2nd sentence of title read, "This is also a Class III area . . . ?"

P. TC 3-10, Water Uses

38 Does the 50.4 ac-ft/yr of water per 10^6 tons of coal produced include irrigation water if this is needed?

Letter 9 Responses

1. Text has been revised to include this information (Regional, Chapter 7).

2. The rates of growth shown in the updated socioeconomic material used in the final ES are based on the most recent (1977 and 1978) data available to the team. Secondary effects are identified wherever information was available.

3. The boom-town effect is mentioned throughout the document as related to efficient rates of growth. Specific impacts are addressed where specific information is available.

4. These statements are not specific enough to add to the site-specifics; however, Regional, Chapter 3, has been revised to include the suggested statements.

5. Geohydrologic data are not presently sufficient for making a meaningful estimate of the total quantity of ground water available in the southwestern Wyoming ES region. However, data from the individual mine plans and from published sources indicate that ground water sources, augmented by impounded runoff, are sufficient to supply the needs of the individual proposed developments. The State of Wyoming still has unappropriated surface water in the Upper Colorado River Basin which drains virtually all of the southwestern Wyoming region. The State expects that most, if not all, of this unappropriated water will be put to beneficial uses in Wyoming. Of course, any diversion of the unappropriated water must be authorized by the State Engineer. At the present time (1978) more than 100,000 acre-feet per year of water in Fontenelle Reservoir is available for purchase from the State.

6. The estimated 9 years was based on "state of the art" reclamation results reported in mined-land reclamation publications, on observations of trial plots at coal mines in the ES region, and on observations of reclaimed highway rights-of-way and oil and gas disturbed areas.

Near Tucson, Arizona, DeRemer and Bach (Thames ed. 1977) appear to have successfully established shrubs and trees on a 40% slope of copper tailing. Drip irrigation and fertilizer were employed. Thirty-month-old mesquite trees and selected shrubs have grown to a height of 9 feet. At the beginning of the third year following planting, vegetative cover was 60% or more on the treated area and was said to blend in well with the surrounding desert.

Aldon and Springfield (Thames ed. 1977) have secured very promising revegetation results on coal mines in New Mexico. One mine is in an area receiving but 6 to 7 inches of annual precipitation. Sandy and shaley, saline soils are present at the mine. Shadscale and Nuttal saltbush are principal shrubs of the area. These shrubs are also common in the ES region. Supplemental irrigation during the first growing season has enabled fourwing saltbush and alkali sacaton plants to survive after the second growing season.

At a coal mine near Gallup, New Mexico, the direct seeding of fourwing saltbush, without irrigation, resulted in one mature plant per 20 square feet after four years (Aldon 1978).

Reported reclamation results such as these and observations of vegetative cover on highway rights-of-way and oil and gas disturbed areas and study plots on coal mined areas of the ES region indicate that the estimated 9-year period of time of effect reclamation may be reasonable.

The potentials of soils for reclamation are presented in tables in the Regional and site specifics, Chapter 2, Soils. Generally the soils, using United States Soil Conservation Service criteria, rate from fair to poor. A poor rating does not mean that such soils would be unsuitable for use, it does mean that the soils have more limiting factors than better soils.

7. Text revised (Regional, Chapter 2, Air Quality, Air Quality Standards and Regulations).

8. Surface water is scarce in most of the proposed mining areas but not on a regional basis. The State of Wyoming has a remaining unappropriated water allotment in the Upper Colorado River Basin. More than 100,000 acre-feet of water per year is available from Fontenelle Reservoir and is for sale by the State for any beneficial use authorized by the State Engineer. All of the mining companies plan to use ground water augmented by impoundments of ephemeral runoff to satisfy their mining needs.

9. It is the second highest 24-hour TSP level that actually violates the law. The highest 24-hour TSP level is not a violation of the law.

10. Ambient NO_x concentrations will increase from 7% of the state and federal standard to about 12% of the applicable standard. No, the standards will not be violated in industrialized areas.

11. The effects would be insignificant, mainly because ground water sources are little used in the proposed mining localities and because the mining operations require only small withdrawals. Current mining activities do not interfere significantly with any known ground water supplies. Dewatering, or partial dewatering, of local aquifers is necessary in mining operations. However, because the aquifers in this area at the proposed mining depths have a low permeability, the effect of dewatering would not be widespread. As stated in the Regional, Chapter 4, Water Resources, Ground Water section, local ground water and surface water supplies would be affected somewhat; the effect might be considered significant by some local users.

12. Increased water needs for municipal use can be met from existing surface water sources. About 125,000 acre-feet per year is available for purchase from the State from Fontenelle Reservoir, and additional water is unappropriated from Wyoming's allocation of Upper Colorado River water. Use of any water from the Colorado River System must be authorized by the State Engineer.

13. The projected water withdrawals would come from both ground water and surface water sources. The affect of the withdrawals on water supplies and quality is discussed in the Regional, Chapter 3, Water Resources section. The proposed withdrawals would exceed existing withdrawals by 6.2%, or 5,040 acre-feet per year, by 1990 as indicated in Table R4-5 of the draft ES. The State of Wyoming has a remaining unappropriated allotment of water from the Colorado River system which could meet this demand; however, the State Engineer must decide on how this unappropriated water will be used.

14. Tables R1-3 and R1-4 in the draft ES contain no estimation of water withdrawals. The basis for estimating water requirements is given in Table R1-5 of the draft ES. The water requirements for the various uses were taken from the following:

a. per million tons of coal mined--Black Butte mine plan and experience at ongoing mines;

b. per million tons of trona mined--USGS, Conservation Division, and experience of trona mining companies;

c. power plant (water cooled)--USGS Circulars 556 and 703; and

d. per 1,000 population--S. W. West, District Chief, USGS, Cheyenne, Wyoming, written communication and from present municipal withdrawals in Rock Springs and Kemmerer.

A water shortage is unlikely in the time period (until 1990) considered in this statement. More than 100,000 acre-feet per year of water stored in Fontenelle Reservoir is currently available for purchase from the State, and additional unappropriated water is still available for beneficial use (subject to authorization by the State Engineer) from the State's allocation under the Upper Colorado River compact.

15. Perspective has been shown by comparing losses as the percentage of existing resources where data were available. This method of presentation provides the reader a basis of interpreting the degree of significance.

16. Section 106 refers to Section 106 of the National Historic Preservation Act of 1966 (16 USC 470f, as amended, 90 Stat. 1320).

17. We know of no one able to locate data which would provide a method to show what tolerance levels exist on wildlife from visitor use.

18. Future exploitation of oil shale in the region is still an unknown. Economic factors controlling oil shale development are currently unfavorable. Oil shale resources are large and will require a separate future consideration.

19. This problem is fully discussed and quantified in the impacts chapter, Regional, Chapter 4.

20. Text revised (Regional, Chapter 3, Solid Waste Disposal).

21. Text revised (Regional, Chapter 3, Land Quality). Since no impacts are anticipated to affect wilderness values, the Wilderness Act was not included.

22. There are no water use plans associated with the proposed actions other than use of the small quantities needed for mine operations and the additional use that would be required by growing municipalities. The relationships of the proposed mining to water use controls and authorizations are discussed in the Regional, Chapter 3, Water Quality, Water Impoundments, and Institutional Relationships, State and County, sections.

23. This sentence should read as ". . . below the 150 $\mu g/m^3$ NAAQS . . .." Text revised.

24. There would be insignificant impacts on available surface water supplies. The maximum additional withdrawals of water from either or both surface-water and ground-water sources resulting from the proposed actions would be about 5,040 acre-feet per year. At the present time, there is available for purchase from the State more than 100,000 acre-feet of water per year from Fontenelle Reservoir and as much or more unappropriated water that has been allocated to the State of Wyoming under the Colorado River Compact. Any beneficial use of this unappropriated water must be authorized by the State Engineer. A considerable part of the water to be used at the individual mine sites (included in the 5,040 acre-feet) would come from mine drainage, water impounded in sediment catchments, and from pumped wells. Thus, withdrawals from available surface water sources would be less than 5,040 acre-feet per year.

25. Bitter Creek, in the proposed Black Butte Mine area, is the only stream in the region covered by this ES that receives significant quantities of ground water inflow from aquifers that would be disrupted. Reduced ground-water inflow would result in impaired water quality in Bitter Creek only in the low flow season when the water in Bitter Creek may be of poorer quality than that of the ground water. Most of the discharge of Bitter Creek occurs from runoff. During times of runoff, the water quality in Bitter Creek is likely to be better than that of the ground water, and the reduced ground-water inflow would improve the quality of the stream water.

26. Text revised (Regional, Chapter 4, Fish and Wildlife, Fishery).

27. Text has been revised using more current data which has removed this apparent discrepancy.

28. Text revised (Regional, Chapter 6). Published reclamation research, in areas with comparable native vegetation, climate, and soils, indicate that the reclamation of lands proposed for disturbance may be feasible in 9 years. See the site specifics, Chapter 3, Vegetation sections, for mined-land reclamation references cited and Appendix D, References. Also see response number 3. It is recognized that mined-land reclamation requires additional research to find answers to problems.

29. The future environment section puts a time dimension on the environmental description. Trends and changes are emphasized without impact analysis. The No-Action Alternative presents impact analysis of such an alternative. See the revised Regional, Chapter 2F and Chapter 8, No-Action Alternative and Low-Level Scenario, Soils sections.

Chapter 4 is designed to show the impacts of the proposed actions. Chapter 8 is used for the presentation of alternatives to the proposed actions. Cross-referencing of the two chapters could confuse readers. The revised Chapter 8, Comparision Table of Impacts, presents comprehensive proposed actions, regional cumulative impact, and different alternative impact data.

30. Text revised (Regional, Chapter 4, Water Resources).

31. An introduction to the comparison table at the end of Chapter 8, Regional, has been added as well as explanations of the notations NA, V, and NC.

32. Text has been revised to eliminate this duplication in both Chapter 4 and Appendix B, Regional.

33. The acre-inches of soils (by suitability rating) which would be available are presented in the site specifics, Chapter 2, Soils. Mixing of soils would occur. Some areas deficient in topsoil prior to mining would recieve surplus topsoil from other disturbed areas.

34. Sentence revised to read "about 4 miles south of the lease area . . .." The limited ground water data available at this site precluded a detailed discussion of the ground water resource potential.

35. See North Block, Chapters 2 and 3, Water Resources, Ground Water. There are virtually no data on the ground water resources at the proposed site.

36. Clarification made in Chapter 2 of each site specific.

37. See response number 17.

38. Yes, this figure includes all water used at the mine site.

10

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
4015 Wilson Boulevard
Arlington, Virginia 22203

MAY 5 1978

RECEIVED
MAY 8 1978
B L M

Team Leader
Bureau of Land Management
Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

Dear Sir:

This is in response to Mr. Daniel P. Baker's letter of April 12, 1978, requesting our comments on the draft environmental statement relative to the development of coal resources in southwestern Wyoming.

We have reviewed the statement; it seems satisfactory and adequate in scope. None of the described physical and human environmental and socioeconomic analyses would appear to impact upon or be in conflict with the vested jurisdiction and authority of the Mine Safety and Health Administration (MSHA). The ultimate development of the coal resources will not alter MSHA's programs and activities other than to add to our inspection and enforcement schedules.

Thank you for giving us the opportunity to provide these comments.

Sincerely,

Robert B Lagather

Robert B. Lagather
Assistant Secretary
for Mine Safety and Health

//

DEPARTMENT OF TRANSPORTATION
REGIONAL REPRESENTATIVE OF THE SECRETARY
SUITE 1822, PRUDENTIAL PLAZA BUILDING
1050 SEVENTEENTH STREET
DENVER, COLORADO 80202

REGION VIII

May 9, 1978

RECEIVED
MAY 16 1978
B L M

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

Gentlemen:

On behalf of the Department of Transportation, I thank you for the opportunity to review the draft environmental impact statement "Development of Coal Resources in Southwestern Wyoming".

I have no substantive comments on either Volume I, Regional Analysis, or Volume II, Site Specific Analysis.

Sincerely,

William C. Evans

WILLIAM C. EVANS
Senior Staff Officer

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

May 23, 1978

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, WY 82901

Dear Sir:

I am replying to your request of April 1978 to the Federal Energy Regulatory Commission for comments on the Draft Environmental Impact Statement for the Southwestern Coal Region of Wyoming. This Draft EIS has been reviewed by the appropriate FERC staff upon whose evaluation this response is based.

The staff concentrates its review of other agencies' environmental impact statements basically on those areas of the electric power, natural gas, and oil pipeline industries for which the Commission has jurisdiction by law, or where staff has special expertise in evaluating environmental impacts involved with the proposed action. It does not appear that there would be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken.

Thank you for the opportunity to review this statement.

Sincerely,

Jack M. Heinemann
Advisor on Environmental Quality

13

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII
1860 LINCOLN STREET
DENVER, COLORADO 80295

JUN 13 1978

Ref: 8W-EE
D-BLM-J01012-WY

Mr. Bob Armstrong
Team Leader
Coal Environmental Statement Team
P.O. Box 1869
Rock Springs, Wyoming 82901

Dear Mr. Armstrong:

The Region VIII Office of the Environmental Protection Agency has reviewed the draft environmental impact statement for the Development of Coal Resources in Southwestern Wyoming and offers the following analysis. We find the BLM and USGS procedures used to resolve environmental problems associated with coal mining inadequate. Neither mining development nor environmental protection efforts are satisfactorily settled with the existing procedures as described in this statement. EPA realizes that recent legislative changes helped foster this administrative confusion. Even so, efforts need to be made to resolve issues quickly according to applicable law. Specifically, we find the following problems which need to be resolved:

1 (1) The mining plans currently in the possession of the Geological Survey, Conservation Division do not represent either the mining plans addressed in the ES nor the proposed mining plans currently held by these companies;

2 (2) The mining plans have not been adequately evaluated as to compliance with 30 CFR 700 et. seq;

3 (3) The methods of fugitive dust control do not reflect best management practices to reduce particulate emissions and must be considered potentially ineligible for permits under Section 165 of the Clean Air Act as amended;

4 (4) Insufficient data is presented to show that revegetation will be "attainable and assured";

5 (5) The draft statement provides an inadequate and likely inappropriate assessment of the applicability of the Special Bituminous Coal Mine provision of Public Law 95-87 (Section 527);

6 (6) The draft statement provides a premature and inadequate assessment of the presence and protection of alluvial valley floors (Section 515 (6) (10) of PL 95-87);

7 (7) The draft statement does not adequately analyze whether water quality and quantity is suitable for the proposed impoundments and should better assess regrading to the approximate original contour; and,

8 (8) The draft statement does not adequately identify how the conflict between mining and raptor nesting will be resolved.

EPA does not believe all these issues need to be resolved prior to issuing the final EIS. Such a delay is not warranted at present. We have chosen not to pursue delaying the impact statement provided those major issues which are or can be immediately resolved are addressed in a complete manner in the final statement and provided that mitigating measures that would resolve these problems receive the commitment of the Department of Interior for their implementation prior to approval of any mining plans. Based on the procedures EPA has developed to rate the adequacy of draft environmental impact statements, the draft EIS for the Development of Coal Resources in Southwestern Wyoming will be listed in the Federal Register in Category ER-2. This means EPA has environmental reservations regarding the proposed actions and requests additional information as outlined in these comments and specified in the attached detailed analysis. Please send five copies of the final statement for our review. My staff is available to discuss the comments and possible solutions at your convenience.

We are in the process of notifying the Department of Interior, through appropriate channels, of our extreme concern that the Southwestern Wyoming Environmental Statement not set a precedent for future statements by providing incomplete review of compliance with the Surface Mining Control and Reclamation Act of 1977. We will try not to delay this EIS provided the major issues we have noted above are resolved either in the final EIS or prior to mining plan approval.

Sincerely yours,

Alan Merson

Alan Merson
Regional Administrator

Enclosure

Detailed Comments by
the U.S. Environmental Protection Agency
on the
Draft Environmental Statement
Development of Coal Resources in
Southwestern Wyoming

9 The most significant issue avoided by the ES is that of assurance that reclamation is attainable and assured (30 CFR 211.1(b) which states: "The purpose of the regulation in this Part is to assure that all such operations which involve significant surface disturbance take place only pursuant to plans approved in advance thereof and only where reclamation of the affected lands to the standards set forth herein is attainable and assured;..." Data collected for and observations made by EPA indicate that current revegetation success is extremely limited in the area. The results of measurements along vegetation transects located at one of the mines indicate that from one to two years after seeding and irrigation there was some new growth principally from crested wheatgrass. No other perennial species were found and annuals invaded only thirty-three percent of the plots. (USDA-Forest Service Interagency Agreement with Department of Interior - Fish and Wildlife Service and EPA).

10 The ES notes the poor character of soils in the area. The ES does not provide any quantitative evidence that reclamation, especially revegetation, will be successful in these soils or that adequate soils for reclamation exist. EPA therefore strongly suggests to the Department that the ES contain an Appendix, with a summary of the Appendix in the text of the final statement. The Appendix should include measurements of vegetation prior to and after mining, in terms of species (numbers), productivity, and ground cover density accompanied by compilations of management procedures used to prepare seed beds and to seed, mulch, fertilize and irrigate at existing mines and existing experimental sites.

11 It is EPA's hypothesis that the potentials for revegetation success will be highest in the Kemmerer-Rock Springs area only if the following reclamation procedures are followed:

1. Backfilled slopes are low and the length of the slopes is short;
2. All suitable topsoil and suitable overburden is conserved;
3. Soil amendments are applied to improve soil structure;
4. Fertilizers are used at moderate rates in all cases at least two years and in some cases for more than two years;
5. All areas are mulched and additional organic matter added, and
6. All areas are supplementally irrigated for the first two growing seasons.

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We believe that, at a minimum, these requirements should be specifically listed in the final statement as requirements that the Department will place on the operators. Otherwise the impacts on surface water quality (erosion) and air quality may be unacceptable.

12 If quantitative data are not available to verify that revegetation will be successful, EPA recommends the ES include a specific testing and monitoring program for the purpose of measuring revegetation success and a stipulation in all mine plan approvals which states that the Department will revoke its approval if the experimental work and measurements do not give unqualified evidence of potential revegetation success commensurate with Public Law 95-87 within the next five years.

The second major issue is that of utilizing best management practices to reduce fugitive dust. The ES recognizes that fugitive dust from the proposed operations would periodically violate air quality standards at offsite locations. However, there are no specific mitigating measures and operational/environmental alternatives presented in the ES to reduce emissions except road watering. It is this Agency's position that each operator will have to employ the best management practice for fugitive dust regardless of the predicted concentrations during operations. Thus, each mining plan and the Department's approval thereof should stipulate an appropriate combination of the following fugitive dust controls.

1. Pavement or equivalent stabilization of all haul roads used or in place for more than one year.

13 2. Treatment with semi-permanent dust supressants of all haul roads used or in place for less than one year and for more than two months.

3. Watering of all other roads in advance of and during use whenever sufficient unstabilized material is present to cause excessive fugitive dust.

4. Reduction of fugitive dust at all coal dump (truck to crusher) locations through use of negative pressure bag house or equivalent methods. Inclusion of conveyor and transfer point covering, and spraying, and the use of coal load out silos.

Operational alternatives such as modification of mining plans and rates of land disturbance to control fugitive dust should also be evaluated. Orientation of spoil piles from typically N-S directions to E-W directions may have the effect of reducing fugitive dust prior to final grading and revegetation. Specifications of a relatively short period between disturbance and vegetative restabilization could have a simular effect. Careful timing of land disturbance (top soil removal) may also be beneficial.

EPA will issue PSD (Prevention of Significant Deterioration) permits to those mines which have the potential to emit more than 250 tons/year of uncontrolled particulates. All five mines in the site specific analysis

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meet this criteria. However, if a mine has received its permit to construct from the Wyoming Department of Environmental Quality prior to March 1, 1978 and construction commences prior to March, 1979, the PSD permit procedures will not apply. Black Butte will not need a PSD permit since it has obtained its state permit and construction has begun. South Haystack will not need a PSD permit if construction begins before March, 1979. North Block, Twin Creek and Long Canyon will need to apply for PSD permits. In order to obtain a PSD permit, these companies must show they can comply with best management practices to control fugitive dust and model some of these emissions for comparison with PSD increments. Final regulations are pending. The companies should contact EPA's Air Quality and Hazardous Materials Division to request a PSD permit application.

14 The third major issue involves the apparent retention of impoundments in mined areas as alternatives to regrading to approximate original contour. These impoundments are proposed in three of the mine plans (North Block, Twin Creek and Black Butte). We feel the ES has not adequately assessed the proposed post mining contours, especially those creating impoundments, nor does the ES show that the appropriate amount and quality of water will be retained in the impoundments. We believe that any impoundments in this area should be limited to those which retain adequate water of suitable quality. Creation of additional impoundments in the area would appear to run the risk of causing additional increases in salt content in the Colorado River drainage basin through flow depletion. We therefore believe the Department should require all areas under consideration for mining to be returned to the approximate original contour or justify that suitable post mining water supply will exist.

15 The "negative determinations" of alluvial valley floors must be re-evaluated since these preliminary determinations appear to have neglected the hydrologic characteristics of alluvial valley floors and the question of adjacent operations which could have adverse effects on alluvial valley
16 floors. The statement also reflects a lack of knowledge of the potential effects of mining in terms of an increase in total dissolved solids in the ground
17 water system recharged through the spoils. It is questionable as to whether sufficient overburden data are presently available to make such an assessment.

18 Several of the mines have potential conflicts with interference of raptor nests, particularly golden eagles. The final statement should indicate what will happen to these nests as a result of compliance with applicable laws. Consultation and coordination with the U.S. Fish and Wildlife Service should be summarized to indicate any unresolved problems here.

19 Regarding secondary impacts to the communities and their need for front-end money, final EIS should describe the status of possible loans by BLM under Section 317 of Public Law 94-579 (BLM Organic Act of 1976) and the status of allowable uses fundable from coal impact funds.

13

SITE SPECIFIC ANALYSIS

North Block

pNB1-1 "Purpose and Objectives"

20 The mine is described as providing coal for the fourth unit of the UP&L Naughton Plant. That particular unit has not received the necessary construction permits required under the Clean Air Act as amended, and thus the objective of mining by 1982 must be considered speculative since no firm contracts for use of the coal appear to exist.

pNB1-4 "Mining Procedures"

21 The ES indicates that mining will be conducted using truck and shovel operations. However, the mining plan specifically addresses dragline operations (p 16 of mining plan). Has the mining plan been modified to use truck and shovel only? Obviously the flexibility of truck and shovel operations to achieve post-mining regrading configurations is greater.

pNB1-8 "Planting and Revegetation"

22 This section indicates that temporary irrigation of revegetated land would be done in all cases. However, the mining plan ("Mining and Reclamation Plan - Federal Coal Leases - North Block", May 16, 1977), states that "sprinkler irrigation of spot areas will also be employed." (page 13). This does not indicate a commitment to supplemental irrigation. Further, the mining plan suggests uncertainty as to the merits of irrigation. This uncertainty does not appear to be adequately reflected in the ES since the mitigating measures do not include a requirement to irrigate.

23 The tests by Kemmerer Coal Company indicating that judicious use of fertilizers has little effect on plant growth appear to be suspect because a nitrogen and phosphorus deficiency is indicated in other tests. Why has the ES presented this apparently inconsistent inclusion with no test data to support it?

pNB1-11 Pgs. NB1-2, "Layout and Mining Sequence"

24 The proximity of the area to be mined from 1981 to 1985 appears to encroach upon the Hams Fork. On page NB 2-8 it is stated: "however,

the flood plains of the Hams Fork is proposed for storage of overburden." The inherent problems of this spoil storage is noted on pages NB 3-13 and NB 3-18. However, mitigating measure #7 merely requires the use of sedimentation pond(s) to prevent degradation of the Hams Fork (pNB 4-1). Does Kemmerer Coal Company still plan to deposit spoil in the Hams Fork flood plain? It is likely that dumping of spoil in the flood plain will not be permitted unless the disturbance of the hydrologic balance, namely the floodplain, and its affect on the distribution of flow is minimized. The "Hams Fork Protection Alternative" (page NB-4) should be implemented to eliminate this problem.

pNB2-8 "Groundwater"

25 The negative determination as to the existence of alluvial valley floors within the areas to be excavated, while possible, appears to be based on criteria not presented in the ES. Soils criteria will not serve as independent indicators of alluvial valley flows. Our analysis of the characteristics of this area indicate the Hams Fork is likely an alluvial valley floor. Thus the original operations would, at a minimum, be located adjacent to an alluvial valley floor. If this is so, a quantitative analysis of the effect of mining and reclamation on the quantity and quality of flow in the Hams Fork must be substituted for the qualitative analysis reported on this page.

The majority of the water quality analysis presented in the mining plan and repeated in the ES (pp NB 2-12 & 13) represent areas disturbed by mining and associated activities only. The ES alludes to this on page DB 2-8. The ES also states that Table NB 2-5 contains a partial

samples. Pit water samples are reported in the mining plan (Exhibit #3) and in Table NB 2-3. The total dissolved solid content of the pit water ranges from 638 ppm to 7,412 ppm with an average of about 2849 ppm. The surface water sample reported in Table NB 2-5, which include runoff from the disturbed area average 1147 ppm TDS, or 40 percent of the pit water concentrations reported in the mining plan, (or 46% of the pit water analyses reported on page NB 2-9 of the ES).

pNB2-18 "Visual Resources"

26 The locations of the typical views (Figures NB 2-3 thru NB 2-5) are not aligned with the reference map NB 2-4 in this Appendix. Thus the impacts of the proposed mine are difficult to assess. Possible conflicts with views from the Fossil Buttes National Monument should be addressed.

pNB 2-23 "Agriculture"

27 The ES states that "Livestock water within the project area is provided seasonally by impoundments and intermittent springs." We find

no assessment of the effects of mining on these sources of water nor of their role in the pre-mining and post mining use. The quantity and quality of water in the impoundments and springs should be assessed. The adequacy of the water available on the mined area after reclamation should be evaluated against this pre-mining status.

pNB 3-2 et. seq. "Air Quality"

The calculations for suspended particulate emissions are difficult to check. It was not possible to derive numbers associated with coal production rates only. Truck dumping (of coal) apparently assumes an emission rate corresponding to bottom dumping (through end dumping is proposed). When combined with emissions from Twin Creek, violations of the 24-hour, secondary standard are projected (>150 mgm/m^3). The Class II increment for measurement of significant deterioration is exceeded by the projected emissions from the two mines. Yet the mitigating measures prepared in the
28 ES (PNB 4-2) indicate no commitment to control of major sources of fugitive dust (it is assumed that projections of haul road and access road dust include the mitigating measure of watering). It is strongly recommended that all access roads be paved or watered, that all haul roads in place for more than one year be paved, that all other haul roads be routinely treated with a dust supressent and stabilizer and the spoil piles be placed and graded to approximate original contour and vegetated within a shorter time span than is proposed. Reductions in the amount of area disturbed at any one time should be assessed as should disposal of spoil within existing pits operated by the applicant or those operated by other operators in the area in order to reduce the elevation of spoil pits. Thus, mitigating measure #10 (pNB 4-2) must be made positive and be a specific requirement to employ the best management practices for fugitive dust.

pNB 3-14 "Fish and Wildlife"

29 If the estimated period for successful reclamation of disturbed lands is 9 years (pNB 3-14), we have difficulty understanding the ever-increasing "direct loss" of habitat acreage. Further, the basis for the
30 4.5 multiplier used to calculate "indirect loss" is not clear. Since a mitigating measure requiring a revision of the mine plan to avoid the Hams Fork, plus diversion of all runoff from disturbed areas to sedimentation ponds, should protect the fishery values of the Hams Fork, we also inquire
31 as to the basis for assuming that the average population of wildlife will be lost as is done on pages NB 3-18 and NB 3-19. We would expect these estimates to be pessimistic since some members of the population would likely be displaced rather than lost.

pNB 4-1 "Mitigating Measures"

32 Mitigating measure #6 suggests that leaching of salts from soil and overburden would be indicated by monitoring. This mitigating measure would not prevent or control leaching and resultant impacts on water quality or vegetation and would not prevent further impacts unless the

information is developed prior to approval of the mining plan. Rather, if the ES is correct in assuming the potential for water contamination (an increase in TDS may be assumed), the applicant should submit additional overburden analysis (only one hole was cored and reported in the mining plan). The effect of leaching on groundwater quality should be projected beforehand, not measured after reclamation. The projections and implementation of any mitigating measures necessary should be monitored.

pNB 5-1 "Water Resources"

33 We believe that increased erosion from disturbed areas into the Hams Fork would be unacceptable. If the mining plan cannot be revised to prevent such erosion, then the plan should not be approved (see also pNB 5-3).

pNB 8-1 "Operational Alternatives"

34 Limits on the rates of mining, the methods of mining and the layout of the mine would appear to have the effect of reducing fugitive dust. Therefore we feel the alternative section is incomplete.

Other:

35 The post-mining grading cross-sections contained in the mining plan inadequately restores the dragline mined areas to approximate original contour.

Twin Creek

pTC 1-9 Table TC 1-3

36 This table shows seven pits. The mining plan also shows seven pits but says (page 5 of sIII) that five pits will be backfilled. Since pit 1N is the only one with a pond, one pit is unaccounted for. If the ES included adequate maps, the confusion might be lessened.

pTC 1-11 "Water Control Structures"

37 Maps TC 1-2 showing drainage diversions cannot be located in the ES. Maps contained in the mining plan* show the diversions, but no analysis of longitudinal profiles and channel stability is apparent. *(Rocky Mountain Energy Co. Revised January, 1977, 3 volumes, "Application For Permit to Mine.")

pTC 1-13 "Present and Future Land Use"

38 The objective to reclaim all disturbed lands precludes leaving a steep-sloped pit with portions of the highwall and areas laying at the angle of repose since access would be severely limited.

pTC 1-16 "Topsoil Handling and Erosion Control"

39 We are not aware of any exemption to replacing topsoil or equivalent materials on mined areas and therefor all pit walls must be effectively topsoiled.

pTC 1-17 "Planting and Revegetation"

40 This section suggests that backfilled material would be required after topsoil replacement. It appears unlikely that mixing of topsoil and overburden in such a manner is advantageous. Rather topsoil should be placed over previously ripped overburden.

pTC 1-18 "Management of Reclaimed Areas"

41 It would appear that the highwalls proposed to be left in the pit 1N area would have to be managed (fenced and signed) forever. Who has committed to this necessary long-term management?

pTC 2-9 "Ground water"

42 This section states that "there are no lands in the mining proposal which meet the criteria for alluvial valley floors." We reference our comment on the similar statement made for the North Block Mine. We are not aware of any study of the hydrology, geomorphology, soils, or agricultural use of the area and of adjacent areas that would support this statement.

pTC 2-27 Table TC 2-9

43 We presume that the last figure on this page (8,700 on lower right) is incorrect or that the same figure on p NB 2-32 is incorrect (8,200 on Table NB 2-11).

pTC 3-1 "Assumptions"

44 It is assumed that irrigation would be employed. We find no commitment to supplemental irrigation in the mining plan.

pTC 3-2 "Air Quality"

45 The same comments made on the North Block section are applicable here. The major sources of suspended particulates must be controlled using the best management practices.

pTC 3-8 "Topography"

46 The large pit is proposed to be left in a condition that apparently does not permit a land use similar to that existing prior to mining. We see no justification in the ES for retention of this pit. We understand the mining plan to propose a permanent impoundment within this pit. If

this impoundment is allowed, any pitwall must be demonstrated to be stable. Otherwise, the pit area must be graded to blend with the topography of the local terrain and to provide access. Further, we do not see any indications in the mining plan that sufficient water will be available to fill the permanent impoundment. Using the information given on page 3-40 of Appendix D of the mining plan, the groundwater inflow along a 75' x 2000' highwall gives a total of

47

$$Q = AK\ H/S = (5 \times 10^4\ ft^2) \times (10\ gpd/ft^2) \times (1 \times 10^{-5})$$

$$= 15\ gpd$$

$$= 15\ gpd \times 365\ day/yr = 5475\ g/yr$$

Acre foot = 326,000 gallons

$$Q = \frac{5475\ gal/yr}{322{,}000\ gal/af} = .17\ af/yr$$

The annual evaporation (reported as 20 af from the 8.3 acre pond area) would exceed the annual surface runoff (reported at 1.2 af) and groundwater inflow. Evaporation would cause the majority of salts to be left in the impoundment area. If these data are correct, we see no justification for a permanent impoundment.

pTC 3-10 "Vegetation"

48 The fact that reclamation has been achieved in the general vicinity along highways and oil/gas drill pads and associated areas have little to do with reclamation of mined land. There is little evidence of successful revegetation at the present mined sites that have been reclaimed.

pTC 3-18 "Visual Resources"

49 It is indicated that the 500' highwall would remain unvegetated. Further, the pitwall would cause a deterioration of visual resources. We believe this to be unacceptable.

pTC 4-1 "Measures"

50 Measure #3 is identical to mitigating measure #6 for North Block As noted for the North Block, monitoring during operations will not prevent contamination or dimunition of flow. The monitoring program is needed, but should be used to check predictions made prior to approval of the mining plans.

pTC 5-1 "Water Resources"

51 Why are the adverse impacts for Twin Creek any less than the adverse impacts projected for North Block (pNB 5-1)?

pTC 8-1 "Operational Alternatives"

52 Reclamation to approximate original contour is not included under alternative analysis.

South Haystack

pSH 1-6 "Watercourse Diversions"

53 A permanent division of about 1,200 feet is proposed for Haystack Draw, the location of a permanent disposal of "excess" spoil. The Mining Plan does not facilitate a review of the compatibility of this permanent diversion with the existing drainage system located downstream. The location of channel capacity measurements is uncertain. It would appear that a channel capacity of 560 cfs from Haystack Draw is to be diverted to a tributary channel with a capacity of less than 1300 cfs (calculated using the Manning Curve) and that the diversion does not maintain the longitudinal profile of Haystack Draw. The ES does not give ev.dence supporting the statement (pSH 1-8) that no additional erosion hazard will exist. The compaction and protection procedures prepared for this new drainage (p 145 of mining plan) appears to have merit.

pSH 1-9 "Overburden Removal and Disposition"

54 It is not clear in the ES as to what quantitative methods were used to determine that excess spoil necessitating permanent disposal of the mined site. There is no evidence of insitu bulking measurements (measurements of increased volume and any subsequent compaction). It is unfortunate that the ES does not include pre-mining and proposed post-mining topographic maps. While the mining plan (Mining and Reclamation Plan for South Haystack Project Revised, December 1976 by RMEC 4 volumes) does contain such maps, we cannot be assured that these are the same maps (Appendix F) used by the Department in preparing the ES. In any event, fhe ES should examine the alternative of eliminating all permanent spoil disposal areas located on other than the mined area. If "off-site" disposal is justified, the disposals must be analyzed for mass and erosional stability, leaching and effect on water quality, and adequacy of construction procedures. Temporary disposals would not require as thorough an analysis. We recognize the ES observation that "the final objective is to maximize the extent of backfilling and minimize the size of overburden dumps" pSH 1-10. However, the mining plan should be approved only after a more quantitative analysis of the need and acceptability of placing spoil permanently in Sections 1, 2, 3 of T16N, R118W, and in Sections 29 and 17 (not shown on Map SH 1-2, but noted on pSH 1-9) of T17N, R117W.

PSH 1-10 "Backfilling and Overburden Dumps"

55 "Partial backfilling" of the remaining highwall needs to be further described to insure compliance with requirements to achieve approximate

original contour level to minimize disturbance to the hydrologic system.
56 Why is 5 feet of cover used here and only 4 feet for North Block (See page SH 4-1)?

pSH 2-7 "Ground Water"

57 As noted for the previous two mines, we are not aware of any supporting information that eliminates the valleys with active streams from consideration as alluvial valley floors. The proposed mine may, at a minimum, be adjacent to alluvial valley floors.

pSH 2-7 "Surface Water"

58 The observation that portions of streamflow is ground water discharge from the Adaville aquifers suggests that mining will reduce, if not eliminate, this source either temporarily or permanently. This impact is not identified in the impact section (ppSH 3-8 and 9). On page SH 3-9, the discussion includes only seepage losses across the reclaimed areas and does not address any impacts of reduced base (groundwater) flow.

pSH 3-1 "Assumptions"

59 Assumption #6 appears to go beyond any commitments in the mining plan for irrigation. As necessary as supplemental irrigation may be, it would appear to have to be listed as an additional mitigating measure in Chapter 4.

PSH 3-2 "Air Quality"

60 The comments provided regarding the North Block and Twin Creek proposal apply here.

pSH 3-7 "Topography"

61 This section describes the apparently major changes in topography expected by spoil disposal of the mine site and by the post-mining grading procedures. We believe that the potential for adverse changes in topography and the hydrologic balance (e.g. longitudinal profile of streams and subsequent erosional stability) is sufficiently high so as to warrant the presentation of a detailed analyses of alternatives to post-mining topographies for the disturbed lands. This would involve evaluation of alternative mining plans.

pSH 3-9 "Ground Water"

62 We believe that a more precise estimate of the impacts on the effect of mining and reclamation on the water table(s) and on water quality is necessary prior to mine plan approval in order that (1) the long-term effect of mining and groundwater may be evaluated as either acceptable or unacceptable. Similarly, the potential sediment discharge described as "unquantifiable" should be quantified to permit development of adequate sediment control facilities.

pSH 3-14 "Wildlife - Birds"

63 The projected impacts on sage grouse are significant even though we believe the estimates are conservatively high because of the potentials for some adaptation of sage grouse to other areas. It would be appropriate to cite references that support the pessimistic conclusions reached regarding the loss of up to 13,000 sage grouse through the life of the mine. The importance of justifying the projected impacts is emphasized by the proposed alternative to the proposed action (pSH 8-1) which recommends that 3,300 acres of adjacent land (unmined) be set aside and managed for wildlife. The final environmental statement should address or reference any existing literature which discusses the effects of surface mining on sage grouse and the measured successes (or failures) of moving sage grouse to new strutting grounds and to new nesting grounds.

64 It is also our understanding that elimination of an eagle nest through disturbances would be possible only with prior approval of the U.S. Fish and Wisllife Service -- and likely a permit from that organization of an adverse disturbance of an active eagle nest was anticipated. On page SH 8-1 the ES says five raptor nests would be lost. On page SH 8-1 it says ten raptor nests will be involved. We are uncertain as to which number is correct. Coordination with the Fish and Wildlife Service should be summarized in the final statement.

pSH 4-1 "Measures"

65 Mitigating measure #3 involves sampling of water and is presented as a method to "reduce potential degradation of surface and groundwaters from leaching of salts and/or trace metals. Sampling of reclaimed areas will not prevent degradation of water quality by such leaching. If projections of leaching and effects on water quality cannot be made, more core holes and chemical-physical analyses should be done.

Long Canyon

66 p. LC 1-10 - The ES states that during full retreat, barrier pillars and chain pillars would be extracted consistent with safe mining practice. The FES should evaluate this practice in terms of the surface effects of any resultant subsidence (especially since subsidence up to 30 feet at the surface is expected).

67 p. LC 1-10 - Reclamation - areas requiring reclamation should include the waste fines slurry pond (as shown on Figure LC 1-2) if a preparation plant is planned.

68 p. LC 1-11 - Operational Environmental Monitoring - Why are there no plans for water monitoring (e.g., groundwater monitoring and monitoring quality of mine water)? Is any subsidence monitoring planned?

69 p. LC 2-9 - Surface Water Quality - What is the basis for the statement in the ES that surface water quality in the Long Canyon project area is of about the same quality as that sampled at the Black Butte project area?

70 p. LC 3-8 - Environmental Impacts of Topography - What is the projected impact of subsidence on the proposed post-mining land use?

71 p. LC 3-8 - Environmental impacts to water resources - Groundwater - What are the estimated mine dewatering rates and qualities? What is the estimated post-mining groundwater quality in the mine area (upon subsidence and saturation of overburden materials)?

72 p. LC 4-2 - Analysis of Effectiveness of Mitigating Measures - We fail to see how monitoring groundwater will reduce reclamation losses from salts or trace metals by 80%.

Other Comments - Long Canyon

73 1. What is the expected quality and quantity of waste rock that is expected to be encountered during mining? How will it be disposed of?

74 2. In the description of the project, reference is made on page LC 1-4 to a coal preparation plant (and also to a waste fines slurry pond). Details should be given for these components of the project and environmental impacts should be estimated (e.g., air quality impacts, groundwater effects from slurry wastes, etc.)

75 3. As noted for the other mining proposals, EPA recommends that access roads be paved or watered.

Black Butte

76 Though this mine plan is the best mine plan of the five reviewed in that it provides clearly a description of the existing and affected environment with quantitative analyses of potential impacts and mitigating measures, we cannot assume that the current mine plan represents the plan addressed by the ES.

77 p. BB 1-16 "Planting and Revegetation"

This section indicates potential supplemental irrigation. EPA considers supplemental irrigation to be essential for revegetation success. The mining plan (p. 78, Volume I) suggests a tentative interest in drip irrigation. It is not clear how drip irrigation could suffice for area irrigation of cover crops.

78 p. BB-1 "Watercourse Drainage Channels and Impoundments"

Eight permanent water impoundments are proposed. The Mining Plan also provides alternatives for external drainage. In view of (1) the low

precipitation and low runoff; (2) the high evaporation rate and (3) the potential to fill the ponds with sediment, EPA believes a preferable alternative is to regrade to approximate original contour, to provide for external drainage that minimizes disturbance to the hydrologic balance, and to construct any approved impoundments in a conventional manner with dams, spillways and commitments to long-term maintenance. A "test pond" (p. BB 3-13) would be appropriate to evaluate the construction of dam-related impoundments. The alternative topography which involves no impoundments, while it clearly shows external drainage and raised contours in the reclaimed pit areas, shows no lowering of adjacent topography as would theoretically be required to provide the necessary spoil. Thus, we cannot be assured that the alternative has been precisely calculated and proposed using accurate spoil "bulking" values.

p. BB 2-4 "Soils"

79 EPA is concerned about the apparent lack of factual data supporting the contention that soils developed on wind-blown deposits and the alkaline soils can be successfully reclaimed. If supporting literature cannot be derived, then field tests must be conducted and reported prior to approval of the mining plan. The use of soil amendments must be evaluated. Table BB 2-3 also reflects our concern that inadequate soils of appropriate quality are available for reclamation.

p. BB 3-2 "Air Quality"

80 Our comments regarding the inadequacy of fugitive dust control measures specified in the cover letter apply here also.

p. BB 3-21 "Wildlife"

81 As noted for the South Haystack proposal, the projected loss of 29 reptor nests (p. BB 8-1 says 58 raptor nests) is not permissible until the Fish and Wildlife Service has given permission and issued the appropriate permits for the eagle nests involved. The necessary approvals should be obtained prior to approval of the mining plan. Coordination to date should be summarized in the final statement.

p. BB 4-1 "Measures"

82 As noted for other proposals, the mitigating measure proposed to protect water quality is inadequate unless much monitoring is performed prior
83 to mining. The air quality control measure should be more specific.

Letter 13 Responses

1. Mining plans are continually being revised or changed in some manner, and such is the case with the mining and reclamation plans analyzed in this ES. At some point in time it is necessary to stop accepting, for inclusion into the ES, changes to the mining and reclamation plans. Such a date was set in order to allow the preparation of the document to continue without constant and continued revision of the ES caused by changes to the plans. Changes in mining and reclamation plans may or may not affect impact analyses. Impact analysis in the ES is generally on a worst-case basis. As the mining plans are revised for inclusion of SMCRA requirements, they will be reviewed by the Office of Surface Mining and the USGS for differences of environmental impacts from those identified in the ES. Such differences, if significant may require separate environmental analyses.

2. The mining and reclamation plans are being returned to the respective companies for revision to include compliance with the initial regulations, 30 CFR 700. When the plans are revised and returned to the USGS, they will be evaluated for adequacy of compliance with these initial regulations.

3. The modeling effort reflects all mitigating measures discussed in the mining and reclamation plans on file with the USGS at the time the ES rewrite began. Even though the fugitive dust control methods used may not reflect present best management practices, comparison of the relative impacts of individual mines can be made, and the emission sources which contribute significantly more to the mine impact can be easily identified. In addition, a best management practice alternative is analyzed in Chapter 8 of each site specific. Specific recommendations are included in this alternative, and a comparison to the proposed action impacts is shown.

4. Current reclamation publications indicate that reclamation is feasible in areas of the United States with highly similar vegetation, climate, and soils to that of the ES region. The site specifics, Chapter 3, Vegetation, present references pertaining to the areas and also discussions concerning the status of coal mine reclamation in the region. The reclamation alternatives presented in Chapter 8 of each site specific present a procedure which would result in on-site data gathering to prove if the lands proposed for mining are, in fact, reclaimable within a reasonable period of time.

5. At the time of the preparation and issuance of the draft ES, interpretation and applicability of the Special Bituminous Coal Mine provision of Public Law 95-87 (Section 527) was, and is still, under consideration by the office of the Secretary of the Interior. This will be completed prior to approval of any mining and reclamation plan presented in this ES. In any event, the provisions of Section 527 do not set aside prior administrative findings or decisions by the State.

6. Text revised (site specifics, Chapters 2, 3, and 4, Water Resources, Surface Water).

7. Text revised, see the Regional, Chapter 3, Water Impoundment section, for a discussion of requirements the mining companies must meet in regard to water impoundments prior to approval of the mining and reclamation plans.

Additional information pertaining to grading to the approximate original contour will be forthcoming when the mining and reclamation plans are returned to the applicant for revisions to include the provisions of SMCRA and then resubmitted by the applicant for further consideration by the USGS and the Office of Surface Mining. Revised detail will then be available to better assess this concern.

8. As of our last coordination meeting with the U.S. Fish and Wildlife Service (Region 6 office, Denver, Colorado, 2 June 1978), our understanding is as follows:

A. This is a matter of continued coordination.

B. All conflicts will be resolved on a case-by-case or site-by-site basis during the process of coordination with the U.S. Fish and Wildlife Service under the Bald Eagle Act of 1969.

C. Regulations to allow removing, relocating, molesting, or disturbing eagle nests under the "Other Activity" clause of the Bald Eagle Act are presently in draft form and are being reviewed. These regulations are scheduled to be in final form and issued during the calendar year of 1978.

D. Each conflict is tentatively scheduled to be resolved in the field by an eagle nesting conflict (E and C) team composed of a U.S. Fish and Wildlife Service officer, a U.S. Fish and Wildlife Service Eagle Biologist, a biologist from the land management agency involved, and a company representative.

E. All legal permits to molest, disturb, remove, or relocate eagle nests will have to be obtained by the individual mining company and (or) corporation involved from the U.S. Fish and Wildlife Service, Law Enforcement Branch, once the appropriate regulations under the Bald Eagle Act are issued.

F. All costs associated with molesting, disturbing, removing, relocating, or compensating for eagle nests under permit from the U.S. Fish and Wildlife Service, Law Enforcement Branch, will be the sole responsibility of the individual mining company and (or) corporation involved.

9. In recognition of the limited reclamation data available in the ES region, reclamation alternatives are presented in the site specifics, Chapter 8. The alternatives present a procedure which would result in on-site data gathering to prove if the lands proposed for mining are, in fact, reclaimable within a reasonable period of time.

10. See response number 4.

11. See the Reclamation Methodology Alternatives presented in the site specifics, Chapter 8.

12. See the revised site specifics, Chapter 3, Vegetation, and references cited. The Wyoming Environmental Quality Act of 1973, as amended, and Federal Regulation 30 CFR 700 provide reclamation standards and penalties for noncompliance.

13. See response number 3. Text revised (site specifics, Chapter 8, Air Quality Alternative).

14. The creation of water impoundments would depend on water supplies of adequate quality and quantity. Text revised (Regional, Chapter 3, Water Impoundments).

15. Text revised (site specifics, Chapters 2, 3, and 4, Water Resources).

16. Any attempt to estimate the "increase" in total dissolved solids in the ground water system would be at best a guess. The subject is extremely complex. It is now the subject of a large research effort by several organizations, two of which are the USGS, presently working in the Powder River Area, and the Montana Bureau of Mines and Geology, in the Decker-Coalstrip Area in Montana.

17. The problems in predicting potential increased total dissolved solids in ground water were recognized. For an example see Black Butte, Chapter 3, Water Resources, Ground Water.

18. See response number 8.

19. Text addition made (Regional, Chapter 8 Socioeconomic Mitigation Alternative).

20. Text revised (North Block, Chapter 1).

21. Text revised (North Block, Chapter 1, Mining Procedures).

22. The North Block mining and reclamation plan filed in July 1975 with the Office of the District Mining Supervisor, USGS, Rock Springs, Wyoming, was used for impact analysis. This plan indicates that supplemental irrigation would be employed.

23. Mined-land reclamation publications indicate variable results are obtained from fertilization treatments (Vories ed. 1976 and Thames ed. 1977). Fertilization does not, in all cases, improve seed germination and seedling establishment.

24. The North Block mining and reclamation plan filed in July 1975 with the Office of the District Mining Supervisor, USGS, Rock Springs, Wyoming, indicates that the spoil pile would be on the Hams Fork floodplain. However, the revision of the North Block plan would incorporate the provisions of SMCRA, and interim Office of Surface Mining regulations, 30 CFR 700, would not allow a spoil pile on the floodplain as described in the mine plan.

25. Text revised (North Block, Chapters 2, 3, and 4, Water Resources, Surface Water).

26. Correction made, see Figures NB2-10A thru NB2-10C, North Block, Chapter 2. Views from the Fossil Buttes National Monument are not possible due to a high large ridge between the proposed mine and the Monument.

27. Text revised (North Block, Chapter 2, Agriculture). (Livestock water within the project area is limited to a few undeveloped springs and to natural catchments along ephemeral drainages.) The water quality production of the undeveloped springs is unknown. State of Wyoming water quality standards would provide parameters for determining post mining water suitability for livestock and wildlife.

28. See response numbers 3 and 13. Also, text revised (site specifics, Chapter 4, Air Quality mitigation).

29. See discussion of reclamation, Regional, Chapter 4, Fish and Wildlife section.

30. Certain wildlife species, such as the leopard frog, would not be indirectly affected whereas other species, such as the golden eagle, could be affected in an area of up to 5 times greater than the actual area of disturbance. An average of 4.5 times the actual disturbance was used to hopefully represent the large number of species involved in the action.

31. Text revised (North Block, Chapter 3, Fish and Wildlife, Fishery).

32. Precipitation ranges from 7 to 12 inches per year and evaporation is about 30 to 36 inches per year. Little in the way of leaching is likely to occur. It was felt that a monitoring program would effectively detect any leaching that might occur. Van Voast et al. (1976) found few significant trends caused by leaching or the replacement of coal aquifers by spoils. Thus prediction is speculative at best. Observation is necessary. While this mitigation will not correct any unexpected problems, it will serve as a tool for early detection of unpredicted changes, which in turn can be used to develop any needed changes.

33. The North Block mining and reclamation plan is being returned to the Kemmerer Coal Company for modification to incorporate the requirements of SMCRA, see North Block, Chapter 1, Surface Mining Control and Reclamation Act section.

34. These measures could possibly reduce fugitive dust emissions if carefully considered and implemented. However, no specific mining plan changes have been suggested, making it extremely difficult to do any useful computer modeling.

35. See North Block, Chapter 1, History and Background, last paragraph, for a discussion of Section 527 (Special Bituminous Coal Mines) of SMCRA.

36. The January 1977 revised Twin Creek mining and reclamation plan, filed with the District Mining Supervisor, USGS, was used for analysis of impacts. This plan indicates that only Pit 1N would remain after mining (see page 6 III of the January 1977 revised plan).

37. Text revised (Map TC1-2 is now included in Twin Creek, Chapter 1). After impact analysis, it was determined there would be no adverse impacts where diversions interrupt and then the water reenters the same natural stream channel.

38. See Twin Creek, Chapter 1, History and Background, last paragraph, for a discussion of Section 527 (Special Bituminous Coal Mines) of SMCRA.

39. See Twin Creek, Chapter 1, History and Background, last paragraph, pertaining to Section 527 of SMCRA and 30 CFR 716.4 (Special Bituminous Coal Mines). The steepness of the pit walls would physically prevent topsoil stabilization.

40. The referenced section states that ripping usually "would be done after the topsoil is spread." The treatment would provide needed topsoil stabilization on slopes and improved water infiltration into both plant growth mediums. There would be minimal mixing of the two materials. Subsoil underlying the topsoil would be selected to avoid factors restrictive to plant growth.

41. The BLM is responsible for management of this area. This responsibility includes fencing and (or) necessary signing for hazard reduction on public lands so long as they are under BLM jurisdiction.

42. Text revised (Twin Creek, Chapters 2, 3, and 4, Water Resources, Surface Water).

43. These tables have been revised to reflect new data.

44. The mining and reclamation plan does not provide for supplemental irrigation. The time estimates of 8 and 9 years to effect reclamation on nonmined and mined disturbed areas, respectively, were based on the assumption that supplemental irrigation would be employed when necessary to achieve seed germination and seedling establishment. Without irrigation, reclamation would be delayed during years when soil moisture is inadequate. State and federal regulatory agencies would not allow unreasonable delays in effecting the reclamation of disturbed lands. Assuming soil moisture and conservation practices would prove inadequate to effect timely reclamation, then supplemental irrigation would be a feasible treatment to correct soil moisture deficiencies.

45. See response numbers 3 and 13.

46. The revised Twin Creek mining and reclamation plan submitted to the District Mining Supervisor of the USGS in January 1977 appears to qualify for certain reclamation exemptions (highwalls to be allowed to remain, benches allowed, etc.) under Section 527 (Special Bituminous Coal Mines), of SMCRA 30 CFR 716.4 (Special Bituminous Coal Mines).

47. While it is true that water in the impoundment would evaporate and would deposit salts within the impoundment, other considerations are also included in evaluation of the impoundment. While the water may be of questionable quality and quantity, it could provide a temporary source for wildlife. See Twin Creek, Chapter 1, History and Background, concerning the application of Section 527 (Special Bituminous Coal Mines) of SMCRA of 1977 and Twin Creek, Chapter 1, Surface Mining Control and Reclamation Act section, concerning return of the mining and reclamation plan to the applicant for modification to incorporate the requirements of SMCRA.

48. A comparison of highway right-of-way and oil and gas disturbed area reclamation with mined-land reclamation within the region is believed valid because:

1. The climate of these areas is identical.
2. Soils encountered on nonmined disturbed areas, at specific sites, are of the same map units as those proposed for mining.
3. The fauna of the region attracted to and capable of damaging seedlings on nonmined disturbed areas would likely be similar to animals attracted to mined lands in the process of reclamation.

4. Highway cuts are as steep or steeper than slopes proposed on mined lands.

5. Highway cuts occur on different exposures (north, south, east, and west), as would slopes on lands proposed for mining.

Differences between nonmined- and mined-land reclamation are:

1. Mined-land slopes would be topsoiled, whereas highway cuts are often not topsoiled.

2. Mined lands would consist of larger areas of disturbance. (Natural plant succession can be expected to occur more rapidly on small areas of disturbance than on larger areas. Erosion of soil from wind and water action would also represent a greater hazard on larger acreages as compared to relatively small areas of disturbance.)

3. Greater compaction of topsoil due to heavy machinery traffic could occur resulting in lower water infiltration on mined lands compared to nonmined lands. (Ripping is one procedure employed to increase water infiltration.)

4. Topsoil for some areas on mined land would have to be stored for long periods of time.

5. The potential for mixing suitable with unsuitable soils exists on mined lands.

Hodder (Thames ed. 1977), in discussing highway and mined-land reclamation, considered the problems in reclaiming these types of disturbance similar in many respects and dissimilar in others. One major difference expressed was that mined spoils may be manipulated (i.e., farmed, etc.), while roadside problem materials often must be accepted as they exist.

A discussion of some qualifying reasons why reclamation has yet to be achieved on a large scale at two existing coal mines within the ES region is presented in Twin Creek, Chapter 3, Vegetation.

49. The impacts identified in Twin Creek, Chapter 3, including those to visual resources, result from analysis of the mining and reclamation plan submitted to the USGS by the Cumberland Coal Company. Whether or not a 500-foot highwall is allowed to remain a part of the mining and reclamation plan will be a determination made when the plan is resubmitted by Cumberland Coal Company. Refer to Twin Creek, Chapter 1, History and Background section, concerning the application of Section 527 (Special Bituminous Coal Mines) of SMCRA of 1977 and Twin Creek, Chapter 1, Surface Mining Control and Reclamation Act section, concerning return of the mining and reclamation plan to the applicant for modification to incorporate the requirements of SMCRA.

50. See response number 32.

51. At North Block, it is proposed to store overburden on the floodplain of Hams Fork where silt can more easily enter the stream. At Twin Creek, more elaborate protection is planned. Also, see response number 24.

52. This mine was considered under Section 527 (Special Bituminous Coal Mines) of SMCRA of 1977 and 30 CFR 716.4 (Special Bituminous Coal Mines); therefore, highwalls would be allowed to remain, benches would be allowed, etc. However, in response to public review comments, an alternative was developed which provides for reclamation procedures which, in part, are not presented in the mining and reclamation plan (see Twin Creek, Chapter 8, Reclamation Methodology Alternative).

53. Text revised (South Haystack, Chapter 1, Watercourse Diversions).

54. A. Maps provided in the December 1976 revised mining and reclamation plan were used for analyzing the South Haystack project.

B. To require replacement of spoil over the mine-excavated areas instead of as proposed (permanent placement in Section 29) was considered as an alternative. This alternative would, however, result in the following impacts which are greater than impacts of the proposed action:

1. increased degradation of air quality due to increased handling of spoil with additional generation of dust;

2. increased slope steepness of backfilled pits, which would result in overall lowered potential forage production and vegetative cover of reclaimed pit areas;

3. increased impacts to visual resources due to the increased heights of reclaimed pit areas and the lessened ability to blend all disturbed areas with the existing landscape; and

4. delayed reclamation, which would result in additional soil losses, lowered air quality due to dust, increased AUM losses, increased wildlife losses, and increased sedimentation and subsequent lowered water quality.

C. The impacts created by the off-site disposal were analysed in the impact analysis (Chapter 3) and were grouped with similar impacts to the appropriate resource values.

55. The revised South Haystack mining and reclamation plan submitted to the USGS on 13 January 1977 indicates that this mine qualified under Section 527 (Special Bituminous Coal Mines) of SMCRA of 1977. For analysis in this statement, it is being treated as a 527 Special Bituminous Coal Mine. However, a final determination will be made prior to mine plan approval.

56. Text revised (South Haystack, Chapter 1, Backfilling and Overburden Dumps).

57. Text revised (South Haystack, Chapters 2, 3, and 4, Water Resources, Surface Water).

58. Overburden will be replaced in the pits and drainage reestablished. Infiltration will occur and recharge the replaced overburden. The water table will in time be reestablished at an elevation approximating present conditions, and the limited base flow now observed will resume.

59. The South Haystack mining and reclamation plan indicates that a drip irrigation system study would be conducted. State and federal regulatory agencies would not allow unreasonable delays in effecting the reclamation of disturbed lands. Assuming soil moisture conservation practices would prove inadequate to effect timely reclamation, then supplemental irrigation would be a feasible treatment to correct soil moisture deficiencies.

60. See response numbers 3, 13, and 28.

61. Because the principle watercourses in the project area would remain in their present locations; because they would not be significantly disturbed; and because the spoil piles would be graded, covered with 12 to 18 inches of topsoil, and seeded, it is not expected that major problems with erosional

stability would develop (see South Haystack, Chapter 1, Topsoil Handling and Erosion Control).

62. Impacts of mining on the ground water are minimal. Quantification of the potential sediment discharge is specious at best. Data are sparse and the methods of evaluating are derived for humid climates and of questionable value in the arid west. Though these methods may have been used in the arid west, their validity and applicability is a matter of professional judgment.

63. Independent analyses of impacts were done by the BLM based on information supplied by the Wyoming Game and Fish Department and Cumberland Coal Company. Cumberland Coal Company data were supplied by a professional wildlife biologist and used in conjunction with the Wyoming Game and Fish data. Recent comments from the Wyoming Game and Fish Department indicate that the estimate of losses may be too low, since the area is more critical to sage grouse than was previously believed.

A thorough literature search did not reveal any information concerning the effects of surface mining on sage grouse or attempted relocations of strutting grounds.

64. The number of raptor nests lost would be five. The statement in the text was not worded properly and was revised for the final ES, South Haystack, Chapter 8, Fish and Wildlife Mitigation Alternative.

For further information concerning eagle nest disturbance and permits required from the U.S. Fish and Wildlife Service, see same section given above.

65. Text revised (South Haystack, Chapter 4, Mitigating Measure 3). Also see response number 32.

66. The ideal achievement so far as the effects of resultant subsidence would be to mine 100% of the coal from each seam in order to extract all the coal. It is currently technologically impossible to obtain this extraction by underground methods. Mining of barrier pillars and chain pillars would help to achieve a higher extraction rate and thus tend to reduce the amount of differential subsidence at the surface, i.e., some areas that have subsided adjacent to those that have not subsided.

67. Text revised (Long Canyon Chapter 1, Reclamation).

68. Such plans are presented in Long Canyon, Chapter 4.

69. The Long Canyon Mine will be located on formations of the same age.

70. Analysis indicated that there would be no significant impacts from subsidence to expected post-mining land uses including livestock grazing, wildlife habitat, and outdoor recreation.

71. It is anticipated that drainage would be a minor problem. Required dewatering would be used to satisfy mine requirements. Quantity of discharge would amount to about 1,500 gallons per day per 1,000 feet of coal seam exposed. Infiltration through subsidence cracks would be intermittent as flow occurs in ephemeral streams. Ground water quality should not be

adversely affected and would probably resemble water in the Ericson Formation.

72. Text revised (Long Canyon, Chapter 4, Analysis of Effectiveness).

73. See Table LC1-5 and added text showing 33 analyses of overburden material in Long Canyon, Chapter 1, Topsoil Handling and Erosion Control. The pH ranges from 7.0 to 8.3. Other details of the analyses can be obtained from Table LC1-5. Presently no coal treatment facility plans have been submitted. Mine development plans show that about 43,000 cubic yards of waste rock with a composite quality of that shown on the table in Appendix E of the mine plan would be encountered. This waste rock would be used as fill in suitable areas of the coal-handling facility construction.

74. Text revised (Long Canyon, Chapter 3, Water Resources and Air Quality sections).

75. See response numbers 3, 13, and 28.

76. The revised Black Butte mining and reclamation plan filed with the District Mining Supervisor, USGS, on 4 February 1977 was used for the ES analysis.

77. According to DeRemer and Bach (Thames ed. 1977), drip irrigation technology is advancing rapidly to the point where it is economically feasible to go nearly full coverage. Aldon (1978), in the Journal of Soil and Water Conservation, discusses drip irrigation revegetation results at a coal mine in New Mexico. Aldon considers drip irrigation feasible for areas not requiring high plant densities. Plant densities are generally low within the Black Butte project area due to the semiarid environment.

78. Black Butte Coal Company plans to test the feasibility of ponds.

79. Text revised (see Black Butte, Chapter 3, Vegetation, for additional reclamation data).

80. See response numbers 3, 13, and 28.

81. See response number 8.

82. Typical summaries of analysis of water samples of both surface and ground water are included in the Black Butte, Chapter 2, Water Resources section. An elaborate ground- and surface-water monitoring program was undertaken to obtain data for the mining plan.

83. Text revised (Black Butte, Chapter 4, Air Quality).

14

RECEIVED

MAY 11 1978

B L M

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

May 9, 1978

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

Dear Sir:

We have reviewed the draft environmental statement (DES) for the Southwestern Coal Region in Uinta, Lincoln and Sweetwater Counties, Wyoming, received on April 5, 1978. We note from our review of the DES that the Bureau of Land Management does not demonstrate compliance with Section 106 of the National Historic Preservation Act of 1966 (16 USC 470f, as amended, 90 Stat 1320), however the BLM appears to recognize its responsibility pursuant to Section 106, should the proposed project be authorized. Accordingly, we look forward to working with BLM in accordance with the "Procedures for the Protection of Historic and Cultural Properties" (36 CFR Part 800) as appropriate.

Should you have questions, please contact Brit Allan Storey of the Council's staff at P. O. Box 25085, Denver, Colorado 80225, or at (303) 234-4946, an FTS number.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

MAY 22 1978

15

THE STATE OF WYOMING

Commissioner of Public Lands and Farm Loans

STATE CAPITOL BUILDING CHEYENNE, WYOMING 82002

May 19, 1978

PLEASE ADDRESS REPLY TO THE COMMISSIONER

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, WY 82901

Dear Sir:

Reference Draft ES Development of Coal Resources in Southwestern Wyoming, the sentence, "A number of state agencies have development and administrative authority over state of Wyoming owned lands" is incorrect and should be deleted as the lead sentence in the following Land Use Plans, Controls, Constraints Sections:

Volume 1

Page R3-4, Paragraph 4

Volume 2

Page NB2-23, Paragraph 3

Page TC2-19, Paragraph 3

Page SH2-28, Paragraph 3

Page LC2-21, Paragraph 3

Page BB2-31, Paragraph 3

The deleted sentence should be replaced in all six paragraphs with the following: "The Wyoming Commissioner of Public Lands is responsible for the administration, leasing and management of lands owned by the State of Wyoming."

None of our solicited pre-draft comments that we prepared and forwarded to the Bureau of Land Management on 6/7/77 seem to appear in this draft. Those comments continue to be valid and we support their incorporation into fire protection sections.

Very truly yours,

Bryce E. Lundell

Bryce E. Lundell
Asst State Forester

BEL:ml

Letter 15 Responses

1. Corrections made; see revised text as appropriate for changes in the Regional and site-specifics.

2. The comments of 7 June 1977 were considered and, where considered appropriate to impact analysis within the draft ES, were included in the rewrite of the Socioeconomic Conditions sections.

THE STATE OF WYOMING
EXECUTIVE DEPARTMENT

ED HERSCHLER
GOVERNOR

Office of Industrial Siting Administration

SUITE 500 BOYD BUILDING CHEYENNE, WYOMING 82002 TELEPHONE: 307-777-7368

16

MAY 19 1978

May 18, 1978

Team Leader
Coal ES Team
P.O. Box 1869
Rock Springs, Wy. 82901

Dear Sir:

We have reviewed the Regional Analysis of the Draft Environmental Statement on Development of Coal Resources in Southwestern Wyoming. Due to the volume of material presented, we have not attempted to provide detailed comments on the Site Specific Analysis. Our comments on the Regional Analysis are as follows.

Chapter I- Description of the Proposal

Background

Assessment of the projected impacts at only three points in time (1980, 1985, and 1990) tends to mask the real problems. From the employment figures presented in Table R1-2, it appears that the peak population from the proposed action will occur sometime between 1980 and 1985. However, by assessing impacts at only five year intervals, the peak period is not assessed. For example, the employment figures for the development of private coal show no construction employment. It is imperative that figures be presented for each and every year during the time frame evaluated. The socioeconomic infrastruture will be stressed most during periods of rapid growth and at the peak population point. Therefore, a year-by-year projection of population is essential to properly assess the related impacts.

16

Other Major Regional Development

The final statement should include the possibility of a major new trona facility proposed by Tenneco Oil Co. Current plans call for a construction workforce of 800 employees and an operational workforce of 350 employees. The facility is scheduled to begin operation in 1982 (Casper Star-Tribune, April 19, 1978). By assessing impacts only in 1980 and 1985, the construction impacts of this project are missed almost entirely. Additional development of uranium resources is referred to on page R2-100, but no projects are described in this section.

2

Assumptions and Analysis Guidelines

The assumption of a water requirement of 200 acre-feet per year per 1,000 population (approximately 180 gallons per capita per day (gpcd)) used to assess the water requirements for increased population is not valid for this region. Average water use during 1975 in Kemmerer was 286 gpcd, with a maximum daily use of 611 gpcd. Average consumption in Evanston is estimated to be 450 gpcd during the summer and 250 gpcd during the winter (Scenarios: A Forecast of Needs, DEPAD, 1976).

3

Chapter 2- Description of the Environment Air Quality Standards and Regulations

The Clean Air Act Amendments of 1977 were approved in early August of 1977. It is difficult to understand why the Draft Environmental Statement, released in April, 1978, does not reflect the current Federal law. Specifically, the requirements of the Act for nonattainment areas and prevention of significant deterioration should be included in the DES. Further, the designation of the Trona Industrial Area of Sweetwater County as a nonattainment area for total suspended particulates (Federal Register, Vol 43, No 43-Friday, March 3, 1978) should be discussed.

4

Water Resources

The DES is remiss in not discussing the salinity problems of the Colorado River. Current policy in Wyoming is to prohibit discharge of water con-

5

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taining more than 789 milligrams per liter of total dissolved solids to the Colorado River Basin. This standard may be modified to become even more restrictive as a result of current litigation and public policy.

Cultural Resources

6 The total lack of description of Fossil Butte National Monuement is inexcusable, particularly in view of the adverse air quality impact described in Chapter 4.

Socioeconomic Conditions

Sewer Systems and Sewage Treatment

The statement that "water supply in the region is a municipal responsibility" is incorrect. The supply for Rock Springs and Green River is provided by Pacific Power & Light Company.

Chapter 3- The Environmental Impacts of the Proposed Actions

Air Quality

7 As previously mentioned, the trona industrial area of Sweetwater County has been designated as a nonattainment area for particulates. Therefore, any predicted increase in particulates must be offset by a corresponding decrease from existing sources. The regional model-predicted worst-case 24-hour incremental increase of particulates shows a significant increase in the nonattainment area. The DES should address this potential conflict.

Recreation Resources

8 Table R4-10 presents an estimate of the increased recreation demands due to the project. This table is meaningless, however, since no attempt has been made to estimate the distribution of the recreation demand within the region. Current user trends indicate significant over-use problems for some facilities.

9 Indoor recreation has been totally overlooked. The availability, number, and type of indoor recreational facilities should be described for both

private and public facilities. The discription of public facilities should include the appropriate information for the specific type of facility, size, number of staff, operating costs, use, and capacity.

Transportation

10 The DES should evaluate the impact of adding the projected numbers of unit trains through towns such as Green River, Kemmerer or Rock Springs. The cumulative impact of unit train traffic on towns outside the region should also be addressed.

Socioeconomic Conditions

Infrastructure

11 The DES predicts net deficits in the budgets of municipalities in Lincoln and Uinta Counties and in Sweetwater County School District Number 2. Wyoming State law specifically prohibits deficit spending by all units of government. Thus, whenever a deficit is projected, in actuality a shortfall in services will occur. The implications of this adverse impact should be evalutaed, rather than simply stating that deficits will occur.

Public Utilities

12 Tables R4-25 and R4-26 purport to estimate the required sewer and water system capacities. Yet future requirements for Rock Springs and Green River are given as "Not Available". We understood that the purpose of the impact statement was in part to develop such information and provide it to the public. To simply list future requirements data as not being available is not a satisfactory method for handling the question.

Chapter 5- Adverse Impacts Which Cannot be Avoided

13 The anticipated shortfall in housing is not an unavoidable impact. A conscientous effort by all the companies involved to provide adequate housing could mitigate the projected shortfall. One needs only to look

16

at efforts in Wheatland, and Wright, Wyoming, to see that adequate housing can be provided, if the energy companies are willing to meet the challenge. It is unlikely that the required expansion of capitol facilities can be completed in a timely manner. The expected shortfall in services provided should be estimated, and described here.

The total lack of mitigative measures for socioeconomic impacts is inexcusable. Many of the adverse impacts indentified can, and should be mitigated.

Thank you for the opportunity to comment on the draft environmental statement. We hope our comments will be helpful in preparing the revised version.

Sincerely,

Blaine E. Dinger
Director

BED/tr

Letter 16 Responses

1. Text revised (Regional, Chapter 4, Socioeconomic Conditions).

2. This information (Tenneco) is not included in the final ES projections, because it did not become available until 19 April 1978. Projections of socioeconomic data by contractor were made on information 3 months earlier.

3. Water use data collected by the USGS for 1975 in Water Resources Council subregion 1401, which includes most of the southwestern Wyoming region, shows that 37,000 people served by public water supply systems withdraw 7,020,000 gallons per day, and that is close to 190 gallons per day per person.

4. The ES has been revised throughout to include a discussion of nonattainment areas (specificially the Trona Industrial area of Sweetwater County) and PSD regulations.

5. Text revised (Regional, Chapters 4 and 5, Water Resources, Surface Water Quality).

6. Text revised (Regional, Chapters 2 and 4, Recreational Resources).

7. Text revised (Regional, Chapter 4, Air Quality, Impacts of Particulate Emmisions).

8. Text revised (Regional, Chapter 4, Recreational Resources, Visitor Use Data).

9. The indoor recreation was considered; the estimated use, potential use, and impacts due to increased population are in the activity labeled "Urban" on the recreation tables. Table added to Regional, Chapter 2, Recreational Resources, to show by county, number, type, size, and capacity of existing recreational facilities.

10. Text revised (Regional, Chapter 4, Transportation Networks).

11. The following sentence has been added to the Regional, Chapter 4, to clarify analysis: "It is recognized that Wyoming State law prohibits deficit spending at all levels of government; the deficits shown above are estimates to indicate that shortfalls in services or revenues would occur if no countermeasures were taken."

12. Text revised (Regional, Chapter 4, Socioeconomic Conditions).

13. Our definition of a real and committed mitigating measure makes housing an unavoidable impact, because we can't force, regulate, or legislate that companies provide housing. It is discussed in the Regional, Chapter 4, that housing shortages will occur if additional construction is not accomplished.

17

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

State Conservation Commission

2219 CAREY AVENUE PHONE 777-7321 CHEYENNE, WYOMING 82002

WAYNE A. EDGERTON
CONSERVATION COMMISSION STATE EXECUTIVE

DWIGHT KIMSEY
208 WATER QUALITY MANAGEMENT

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EUGENE HARDY (LIVESTOCK BOARD)
JOHN NILAND (D.E.P.A.D.)

May 9, 1978

M E M O R A N D U M

TO: Donald I. Daiss, Assistant Commissioner of Agriculture

FROM: Tim Kautza, District Program Consultant

SUBJECT: ENVIRONMENTAL STATEMENT-DEVELOPMENT OF COAL RESOURCES IN SOUTHWESTERN WYOMING

I have reviewed the draft copy of "Development of Coal Resources in Southwestern Wyoming and offer the following comments for your consideration.

1 Having reviewed the soils, transportation and socioeconomic sections of the regional and site specific analysis, I recommend that more recent and accurate general soils maps be obtained from the local Conservation Districts included in this study area. Those districts are Lincoln Conservation District, Bridger Valley Conservation District, and Big Sandy Conservation District. Their addresses are as follows:

Lincoln CD	Bridger Valley CD	Big Sandy CD
Box 98	Box 386	Box 730
Cokeville, Wy 83114	Evanston, Wy 82930	Rock Springs, Wy 82901
Ph: 279-3256	Ph: 789-2442	Ph: 362-5101

As the soils data has been used to determine reclamation potential, I believe you would seek the most accurate soils information available.

2 Unfavorable soils properties and their effect upon transportation networks and housing development, have not been considered in the impact analysis.

TK/mn/11

Letter 17 Response

1. The most current available Soil Conservation Service soil survey data were utilized at the time the soils maps were compiled.

2. Data are unavailable concerning the exact locations where developments (housing and transportation networks) needed in support of the proposed actions would be sited. It is believed that sufficient technology and expertise exists to avoid or correct problems which might arise in regard to developments in areas with unfavorable soils properties.

18

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

State Engineer's Office

BARRETT BUILDING CHEYENNE, WYOMING 82002
WYOMING WATER PLANNING PROGRAM

June 6, 1978

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

Dear Sir:

My comments on the "Draft Environmental Statement for the Southwestern Coal Region of Wyoming" follow. I have reviewed particularly the water-related portions of the draft statement. I have also included comments on several other points that I noted.

1. There are several references cited in the text of the statement that are not in the list of references in Appendix D of the Regional Analysis, Volume 1.

1 2. Page R1-9, Water Developments: There are some inaccuracies in the discussion, which should not seriously affect the ES. The China Meadows Reservoir has been omitted and its replacement, the Stateline Reservoir, is under construction. The "proposed Sublette project" is not currently under active consideration. A recent study identified as the Sublette Project Investigations is being shelved until there is more certainty regarding future water needs. A status report on this joint federal-state study is in the final stages of review. Current contracts between the United States and Wyoming allow the water originally intended for Seedskadee Project irrigation to be used for industrial purposes, but no future industrial use of water is mentioned in this section of the ES. There should have been some consultation with the State, particularly the State Engineer's Office

2 3. Page R2-1, Surface Temperature, and page R2-3, Table R2-1: The minimum temperature recorded at Farson is considerably below 46°F. Our information indicates that this lowest recorded temperature at Farson was -55°F, and the highest was 107°F at the Green River Aviation Station.

3 4. Page R2-102, Figure R2-18a: The 1990 total does not agree with that shown in Table R2-53, page R2-101, for 1990.

4 5. Page R4-15, Surface Water: "Use of unappropriated surface water. . . " would be contrary to Wyoming law which requires that a permit be obtained from the State Engineer prior to any diversion or impoundment of the state's water. I think the intent was to say, in effect, that the future use of additional surface water would have impacts.

5

"The quality of water in the Lower Colorado River Basin has deteriorated in historic times and any upstream diversions will cause further deterioration". This statement does not go far enough. It implies that the Upper Basin states cannot utilize their full share of the water under the Colorado River Compact of 1922, and in particular, that Wyoming cannot use any additional water from its allocation under the Upper Colorado River Basin Compact of 1948. Estimates of the total depletion allocated to Wyoming range from 805,000 to 1,043,000 acre-feet per year. The state expects that most, if not all, of the remaining unappropriated water under this allocation will be put to beneficial uses in Wyoming. Note that the 1948 compact allocates water among the Upper Basin states on the basis of depletions, where nearly all of the water use material in the ES considers diversions.

6. Page R4-18, top of first column: ". . . release of wastewater from industrial plants." Waste water discharges are subject to water quality restrictions, and water treatment can be expensive. All too often these two factors combine to result in total containment of waste water, rather than treatment and return to the stream. In the western states, where water supplies are limited and shortage is the general rule, every effort should be made to discourage total containment as an alternative to waste water treatment. The development of technology for economic recovery of good quality water should be stressed and encouraged. Total containment should only be considered as a last resort and then only as a temporary measure. The return of waste water to a stream (after adequate treatment) is particularly important in the Colorado River system where water is apportioned to the states on the basis of depletions rather than diversions.

7. Page R4-32 and Page R8-6, Livestock Grazing: "Water needed for mining and other activities could, in some cases, adversely affect water supplies for livestock. Surplus water on deeded lands, however, could be sold by some livestock operators for extra income". (Quoted from page R4-32; the statement on page R8-6 is almost identical).

The adverse effects on livestock water supplies could be real in the physical sense of interference. However, under Wyoming law appropriated water for livestock is protected.

6

The author of the quoted statement should examine the Wyoming Constitution, particularly Article 1, Sections 31, 32, and 33, Article 8, Sections 1, 2, 3, and 5, and Title 41 of the Wyoming Statutes, particularly sections 41-1.22(a), 41-2, 41-3, 41-4, 41-4.1, 41-5, 41-9.1, 41-29.2, 41-121.1, 41-121.2, 41-121.3, 41-123, 41-124, 41-128, 41-132, 41-133, 41-134, 41-141, 41-144, and 41-182 to 41-187. The essence of these constitutional and statutory provisions is the protection of existing water appropriations. The highest preferred use is specified as ". . . water for drinking purposes for both man and beast . . ." (41-3).

Water needed for mining could not legally adversely affect either surface or underground water supplies for livestock without the consent of the appropriator of the livestock water. If a mining operation (or other activity) interfered with a source of livestock water, a restoration or replacement of the water supply could be required.

"Surplus water", from the standpoint of water law, is defined in Section 41-182. If, by "surplus water", water in excess of the appropriator's needs is meant, there are provisions in the law to allow transfer of all or part of the right. Section 41-4 gives the procedure for obtaining the approval of the Board of Control for a change of use, and requires that just compensation be paid if the change of use is approved.

The sections cited above bear directly on the quoted paragraph. There are other sections that are also pertinent to the water-related discussions in the ES.

8. Page R5-1, second column, third paragraph: The projected water diversion figure appears to be too high for the projected population. For planning purposes in the area, a diversion of 1 acre-foot is assumed to supply 5 people for a year with a 50 percent return flow, or a depletion of 1 acre-foot per year per 10 people.

7

Considering the population total of 87,325 people projected for 1990 (Table R4-12, page R4-35) the total municipal diversion requirement would be on the order of 17,500 acre-feet per year. The same table shows a population increase of 29,634 persons by 1990 due to the cumulative impact. The resulting increase in municipal water diversions would be about 6,000 acre-feet per year. We would assume that the depletions due to municipal use would be about 8,750 acre-feet per year total, or about a 3,000 acre-feet per year increase from the present municipal depletions, based on the population figures projected in the ES. The projected population increase due to the proposed actions of 13,783 persons by 1990 (Table R4-12) would require additional diversions of about 2,760 acre-feet per year for municipal purposes.

What "municipal-supplied industrial use by 1990" is expected that would require an increased diversion of 80,000 acre-feet per year beyond the above noted municipal diversions increase? We would not expect the quantity of water supplied by the municipalities for industrial uses to be very large. The quantity could probably be included in the municipal use diversion figures with little error.

Downstream from a point of diversion the dissolved solids load (in tons) would be reduced by the amount in the diverted water, and the concentration of dissolved solids would be the same as above the diversion. At the point of return flow, if any, resulting from the diversion, the dissolved solids load would be increased (but not necessarily to a greater level than that at

the diversion) and the dissolved solids concentration would be expected to increase. The level of increase in either parameter would depend on the use of the diverted water and on any treatment it might receive before being returned. The major effect of diversion and depletion of water would be the loss of generally better quality water, which would not be available for dilution of poorer quality water in downstream reaches. In some situations the diversion of saline water from a tributary for totally consumptive uses (no return flows) could improve the quality of the water in downstream reaches of the main stream.

8 9. Chapter 9 of the Regional Analysis volume does not indicate any coordination with the State Engineer or his Water Planning Program on matters of water rights and water law, compact provisions, water supply, or projected water uses in the Green River Basin. Certain statements and numerical values in the ES make this lack of state water-related information very apparent.

9 10. Page NB2-1, Page TC2-1, and Page SH2-1, Atmospheric Temperature and Stability: Apparently 5°F (page NB2-1) is the mean monthly minimum temperature for January at Kemmerer. The corresponding maximum should be shown. The symbol preceding the 32°F value is confusing, and should be a negative sign.

11. Page NB2-23, Coal, second paragraph: ". . . 9.604% BTU per pound". The percent symbol should be removed, and the decimal point replaced with a comma.

12. Page NB3-4, Figure NB3-1, Page TC3-4, Figure TC3-1, and Page LC3-4, Figure LC3-1: The legend and the title on the figure show units of mg/m^3, where they should be $\mu g/m^3$.

10 13. Page NB3-13, Water Resources: Are there any water rights that would be affected by this proposed mine?

11 14. Page NB3-13, Water Use: I do not agree that a population increase of 1400 persons would use about 480 acre-feet of water per year. At one acre-foot per year for 5 people, the diversion requirement would be about 280 acre-feet per year, and the depletion would be about one-half of this, or about 140 acre-feet per year. (See also comment No. 8, relative to page R5-1).

15. Page TC1-11, first paragraph: There is a reference to Map TC1-2, which seems to be missing. The references here and on other pages indicate that this map is pertinent to the physical situation.

12 16. Page TC2-9, Water Resources: The Table TC2-3a referred to under Groundwater Quality is missing. Table TC2-3 referred to under Surface Water Quality appears to have incorrect identification, and I find no table containing the surface water quality information. Are any water rights affected by this proposed mine?

13 17. Pages SH2-7, SH3-8, and LC2-9, Groundwater: What is meant by the form of the powers of 10 in the permeability and storage coefficient values? These "upside-down commas" have no meaning to me, or to the geologist I checked with about them.

14 18. Page SH2-15, Table SH2-8: What were the stream discharges at the time the quality samples were taken?

15 19. Page SH3-2, Impact on Air Quality: Where are Maps SH3-1, SH3-2, SH3-3, and SH3-4 chat are referenced near the end of the second column?

20. Page SH3-4, Figure SH3-1, and Page BB3-4, Figure BB3-1: The units of mg/m^3 in the figure title are in error. (See also comment No. 12).

16 21. Page LC2-1 and Page BB2-1, Atmospheric Temperature and Stability: The symbol preceding the 29°F value is ambiguous and should be a negative sign. My information indicates a minimum temperature at Rock Springs of -33°F. A minimum temperature of -55°F is reported for Farson, which is only slightly farther from the Long Canyon mine site than Rock Springs is.

17 22. Page LC2-5, Topography: In the last sentence, the "Red Desert Basin" would be better described as the Great Divide Basin.

18 23. Page LC2-9, Surface Water Quality: What is the basis for the assumption that the surface water quality in Cedar Canyon would be about the same as that in the Black Butte area?

19 24. Page LC2-21, Second Column: "The Long Canyon Mine includes 640 acres of state land." Map LC1-1 shows 2 sections (1280 acres) of state land in the mining area.

20 25. Page LC3-2, Impact on Air Quality: Where are Maps LC3-1, LC3-2, LC3-3, and LC3-4 that are referred to in the second column?

21 26. Page BB1-20, Wyoming State Engineer: Has the necessity for any required permits for the surface water diversions and impoundments been investigated?

22 27. Page BB2-1, Moisture: How can one year of data (1975) be reported as "annual average precipitation"?

23 28. Page BB2-16, Table BB2-7: The discharges in Bitter Creek corresponding to the reported quality sampling would be useful information.

Thank you for the opportunity to review, and comment on, this environmental statement.

Sincerely,

Louis E. Allen

Louis E. Allen
Water Resources Engineer

LEA:ew
cc: George L. Christopulos
William Long
Steve Freudenthal

Letter 18 Responses

1. Text revised (Regional, Chapter 1, Water Developments).

2. The minimum temperature recorded at Farson between 1931 and 1960 is 46°F. The maximum for Green River (with records for 1930-1949 and 1951-1960) is 102°F (Becker and Alyea 1964). Text revised (Regional, Chapter 2, Climate, Temperature).

3. Text revised (Regional, Chapter 2, Socioeconomic Conditions).

4. Text revised (Regional, Chapter 4, Water Resources, Surface Water).

5. Text revised (Regional, Chapter 4, Water Resources, Surface Water).

6. Agree--water rights could be purchased and used by industry in lieu of the livestock industry.

7. The water withdrawal data were derived from a water use survey of Wyoming conducted by the USGS in 1975. Unit water withdrawal was derived from these data and projected on the basis of population and reports of industry. Municipal supplied commercial and industrial use per year only increases an additional 3,100 acre-feet by 1990.

8. Text revised (Regional, Chapter 9, Consultation and Coordination in the Preparation of the Draft Environmental Statement).

9. Text revised (North Block, Twin Creek, and South Haystack, Chapter 2, Climate, Atmospheric Temperature and Stability).

10. No water rights would be affected by the proposed mine.

11. Agreed--the correct number is 200 acre-feet per year. Text revised (North Block, Chapter 3, Water Resources, Water Uses).

12. Tables TC2-3 and TC2-3A were inadvertently left out of draft ES. They have been added to the final ES, Twin Creek, Chapter 2, Water Resources.

13. These typographical errors have been corrected.

14. These data are not available.

15. These maps were inadvertently omitted from the draft ES. Text revised (South Haystack, Chapter 3, Air Quality).

16. The minimum temperature at Rock Springs is -29°F (Becker and Alyea 1964). The minimum temperature recorded at Farson between 1931 and 1960 is -46°F (same reference). Farson is outside the ES region. The symbol preceeding the 29°F has been corrected.

17. Text revised (Long Canyon, Chapter 2, Topography).

18. The geomorphology of the two areas is similar.

19. This map has been changed so that only one state section is shown.

20. Text revised (Long Canyon, Chapter 3, Air Quality).

21. The Black Butte mining and reclamation plan indicates that application plans for impoundments and surface water diversions were submitted to the Wyoming Water Quality Division and the Wyoming State Engineer's Office for consideration of permit approval and were approved.

22. Text revised (Black Butte, Chapter 2, Climate).

23. These data could not be located and thus are not available.

19

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Game and Fish Department

CHEYENNE, WYOMING 82002

EARL M. THOMAS
DIRECTOR

STATEMENT FOR PUBLIC COAL MEETING

On behalf of the Wyoming Game and Fish Dept. I would make the following comments relative to coal mining activities and other mineral, oil-gas activities in southwestern Wyoming.

Here we are addressing the anticipated problems of coal mining relative to wildlife and wildlife habitat; however, the affects of wildlife habitat degradation are not restricted solely to coal development. The cumulative affects of increased oil and gas exploration-development activity, increased mineral (especially coal, uranium, trona, phosphate) exploration and development, increased logging activity, more intensive livestock grazing systems, more water development projects, increased recreational activity, increasing numbers of rural homesite developments, and increasing numbers of people residing in this area all complicate the dillemma facing wildlife today. The question is: will we have wildlife tommorrow on our public lands with all of the demands we are asking of the land. Native habitat degradation through increased human developments will decrease the carrying capacity of the land for wildlife and the remaining land area will receive such great people use that many species of wildlife will succumb to the disturbance.

So what is the solution: have no development which would adversely affect wildlife. Well, that is ideal; however, apparantly is not applicable--so we will live with some development, but how much can

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Game and Fish Department

CHEYENNE, WYOMING 82002

EARL M. THOMAS
DIRECTOR

wildlife tolerate and still perpetuate themselves at levels which the people desire.

As our answer, the Wyoming Game and Fish Department in District IV proposes the following: We ask that all federal, state, private and local agency planning and governmental planning groups and organizations adopt our objectives for wildlife populations ~~, as has been established~~ in southwestern Wyoming. After adoption of our objectives and management plans we recommend the implementation of measures to maintain and improve habitats for objective wildlife population levels in southwestern Wyoming.

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Game and Fish Department

CHEYENNE, WYOMING 82002

EARL M. THOMAS
DIRECTOR

2 The Wyoming Game and Fish has available, as public information, wildlife distribution maps, defined critical wildlife ranges and other wildlife populations information. These data must be used by agency and other public planning groups in designing systems which will maintain habitat for objective wildlife populationsin Wyoming; however, we ask that you the public, demand the maintenance of habitats important to wildlife in Wyoming. Without the commitments to maintain habitat for objective wildlife populations we will lose the continuity and quality of native habitat important to wildlife in Wyoming. By working with nature instead of against it we can perpetuate the wildlife important toWyomings Quality of Life.

Letter 19 Responses

1. These objectives will be a consideration in the decision process. Maps prepared by the Wyoming Game and Fish Department under contract to BLM were used in the analysis. In addition, the most recent game distribution maps prepared by the Wyoming Game and Fish Department were used in writing the final ES, and all necessary text and map revisions were made accordingly.

2. These maps are presently being used by BLM (also, see response number 1).

20

IN REPLY REFER TO

1792 (920)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
State Office
P. O. Box 1828
Cheyenne, Wyoming 82001

Dear Reviewer:

Enclosed for your review and comment is a copy of the Draft Environmental Statement for the Southwestern Coal Region of Wyoming.

The statement covers a site specific impact analysis of five proposed coal mines on existing leases, the rights-of-way necessary to develop these mines and a cumulative impact analysis upon the coal region.

The coal region consists of approximately 6.2 million acres and includes all of Uinta and portions of Lincoln and Sweetwater Counties.

We would appreciate receiving your written comments on the environmental statement no later than May 31, 1978, so they may be considered in preparation of the final environmental statement. All comments should be mailed to:

Team Leader
Coal ES Team
P.O. Box 1869
Rock Springs, WY 82901

The wildlife information is inadequate & in some cases misleading! Too vague & broad

Donna Bux
Science Librarian
U. Wyo. Science Library
Laramie, Wyo
82071

CONSERVE AMERICA'S ENERGY

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21

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Department of Agriculture

TELEPHONE: (307) 777-7321 CHEYENNE, WYOMING 82002

LARRY J. BOURRET, COMMISSIONER

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DR. NEAL HILSTON, DEAN
COLLEGE OF AGRICULTURE
UNIVERSITY OF WYOMING, LARAMIE

M E M O R A N D U M

DATE: May 25, 1978

TO: State Planning Coordinator
Wyoming State Clearinghouse

FROM: Don Daiss, Assistant Commissioner
and Liaison for E.I.S. Review

SUBJECT: Regional Analysis Vol. #1 - 2 (Appendix)
Development of Coal Resources in Southwestern Wyoming

State Identifier Number 78-106D

Attached are the comments of Dan Hartley, Department Ag Economist, and comments of the Wyoming Conservation Commission.

These comments reflect those of the Department of Agriculture.

Thank you.

DDjh

Attach.

21

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Department of Agriculture

TELEPHONE: (307) 777-7321 CHEYENNE, WYOMING 82002

LARRY J. BOURRET, COMMISSIONER

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DR. NEAL HILSTON, DEAN
COLLEGE OF AGRICULTURE
UNIVERSITY OF WYOMING, LARAMIE

M E M O R A N D U M

DATE: April 20, 1978

TO: Don Daiss

FROM: Dan Hartley, Ag Economist
Dan Hartley

SUBJECT: Development of Coal Resources in Southwestern Wyoming

I have reviewed the draft copy, Development of Coal Resources in Southwestern Wyoming, and offer the following comments for your consideration.

1 Briefly reviewing the agriculture sections within the environmental statement, I agree with the claim the proposed coal mines will have little direct effect on agriculture in the area. The loss of AUM's to the total AUM in the area will be minimal. However, the impact from people and services to the coal mines could have a wide spread adverse effect on livestock grazing in the area. As more people come into an area, they seek more recreation and outdoor activities. These activities will upset and cause stress to livestock. The adverse effects to the livestock industry could be far greater than losing several thousand acres of forage for feed. Many more AUM's could be lost from people impact.

DRH/rw/jb
cc; Ken Sturman

Letter 21 Response

1. People impacts to the region's livestock industry are recognized (see Regional, Chapter 4, Agriculture).

MH1

22

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Recreation Commission

604 EAST 25TH STREET CHEYENNE, WYOMING 82002

JAN L. WILSON
Acting Director
777-7695

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1001 Pioneer Road
Sheridan 82801
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MARVIN HARSHMAN
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Rawlins 82301
JACK D. OSMOND
P.O. Box 216
Thayne 83127
ALBERT PILCH
1800 Morse Lee
Evanston 82930

May 4, 1978 SIN 78-106D

Mr. Richard Hartman
Wyoming State Clearinghouse
2320 Capitol Avenue
Cheyenne, Wyoming 82002

Dear Mr. Hartman:

Reference is to State Identifier Number 78-106D, Regional Analysis—Vol. No. 1, Site Specific Analysis—Vol. No. 2, plus a map appendix, Development of Coal Resources in Southwestern Wyoming. The Bureau of Land Management is the responsible Federal agency. Comments by the State Historic Preservation Officer (SHPO) pertain only to the cultural environment, the protection of which is a duty of the SHPO.

This is a draft environmental statement compiled at considerable effort and expense. All phases of the environment are presented, it is significant. The SHPO's awareness that the cultural environment is a product of prehistoric and historic developments is reinforced. Should developments cease, the cultural environment, after a time, must itself cease—decompose and vanish. That Statement rests on the theory that now, under the present stage of civilization, the development of energy resources is essential. The facts presented in this Draft Environmental Statement are recognized as true in substance if, in some cases, subject to corrections of detail.

As stated, there are three parts: Vol. 1, Regional Analysis; Vol. 2, Site Specific Analysis; and an appendix of relevant maps. Ordinarily the SHPO confines comments to specific developments because it is the actual material works which sometimes endanger features of the cultural environment. But here the responsible federal agency has first taken note of the regional background. That is good, those responding should comment accordingly.

In the Regional Analysis then, page R4-53, is found the following statement: "Economic benefits resulting from approval of the proposed action would fulfill the expectations of many residents that energy development would have a positive influence on the region". That, of course, is a regional statement, it doesn't take into account the needs of the nation. But it does indicate growth, and growth can only be at the expense of some part of the prior living conditions—like

some impact on the cultural environment. It is within our philosophy that cultural resources are desirable and their protection a worthy endeavor; this statement only implies the necessity for balance between that protection and the continued developments of our society. It is then important that due respect be given to evidence of past developments but their protection must not, willy-nilly, prohibit future developments. With proper consideration it is usually possible to protect the one and still achieve the other. Where that has been done all parties have been proud of the results.

1 The analysis, page R4-28, cites the region's cultural properties that have been enrolled in the National Register of Historic Places or listed in the Wyoming Inventory of Historic Sites (which may qualify for later enrollment in the "Register"). Among them are four properties—Black Buttes Stage Station, Gibraltar Mine Site, Hallville Mine Site, and Cumberland Town Site—which are all nearby specific proposed-developments and, despite arrangements to be saved, may suffer certain impacts. Measures for their individual care must be made within the Site Specific Analysis. Also, the remark is made that many archeologic resources remain undiscovered but that certainly many have become known and inventoried because of studies made for the Statement. This is true.

2 Four hundred and thirty-five sites, mostly archeologic ones, are identified. Many, after investigation, are not found to be of value and some of those will be obliterated by impending developments. Others, of value for the knowledge that they contain, will be salvaged and so some value preserved. What is not explained is that ground disturbance incidental to strip mining will uncover additional sites that would otherwise remain undiscovered. The salvage of these should also add to scientific knowledge.

3 One aspect that is pointed out, which though deplorable must be accepted, is that increased activity will bring an increase in population and that means increased pot-hunting and other vandalism. The statement should indicate increasing protection efforts.

Regarding both historic and archeologic sites, page R3-6 of the analysis states: "Inventories will be conducted on the impacted lands by the surface management agency and stipulations necessary to protect these resources will be included in the proposed mine and reclamation plan". From that observation we can turn to Vol. 2, Site Specific Analysis.

This Environmental Statement relates to five proposed coal mine developments: North Block; Twin Creek; South Haystack; Long Canyon; and Black Butte. Consideration of each is in that order.

The proposed North Block mine is located about 5 miles west of Kemmerer, Wyoming and it covers 2,473 acres within an area 4 miles

long and 2 miles wide. In addition rights-of-way are required for 4.5 miles of power line, 2.5 miles of conveyor and 4.5 miles of access road.

4 Development of the mine will not affect any properties currently enrolled in the National Register of Historic Places nor will it affect any properties listed in the Wyoming Inventory of Historic Sites (which may qualify for future enrollment in that "Register"). It is doubtful if archeologic values of significance will be found in the type of terrain existing throughout the proposed mine area. Still, that is always possible and evidently only a part of the area has been covered by reconnaissance. Before ground is disturbed either for mining or for rights-of-way for conveyors, roads or power lines an archeologist, qualified to work in the Rocky Mountains-High Plains region, should be consulted.

The proposed Twin Creek Mine is just to the south of the North Block Mine and is about three to four miles west of Kemmerer. It covers 2,841 acres. As is true of most, but not all, modern day coal mine proposals it is not located in an area subject to great cultural activity during historic time. The proposed mining would not affect any properties presently enrolled in the National Register of Historic Places, neither would it affect any properties listed in the Wyoming Inventory of Historic Sites (which may qualify for future enrollment in that "Register").

5 Prehistoric cultural properties of significance also have not been found within the proposed mining area. There have been several different archeologic reconnaissance conducted over the surface area without discovery of any site requiring prolonged investigation. These have been conducted by some of the outstanding authorities of Rocky Mountain-High Plains archeology. However, the text is a little confusing on whether all of the area has been covered or if some small part has been neglected. The BLM should consider this matter and make certain that archeologic reconnaissance has occurred over the entire land surface.

6 The proposed South Haystack Mine involves 8,080 acres of land and is to be a strip operation. This area has been subject to complete archeologic reconnaissance. Fifty-four sites of at least some prehistoric activity were discovered in an 8,300 acre (over-stepping boundaries) reconnaissance of the actual mining site and thirteen additional sites were found in a survey of the rail spur. All but a few of these sites were determined not to be significant. The rail spur is to pass through the old town site of Cumberland, an earlier Wyoming coal mining town and listed in the Wyoming Inventory of Historic Sites. There is not much left of the town and, besides, a railroad was indigenous to it in its heyday. It is just best that some care accompany the laying of the new rail spur, not to disrupt historic remains that are not plainly in the way.

7 In addition our information is that the original version (1843-48) of the Oregon Trail passed from east to west a few miles north of the Haystack Mine Site. Therefore, the rail spur line must cross the Trail somewhere. While later developments may have obliterated the Trail's marks, the development should take care not to effect any good signs that remain.

Otherwise the SHPO does approve the determination to have an archeologist present during all disturbance of surface lands.

8 The proposed Long Canyon underground mine is the next site specific. About 31,000 acres are included in the proposed venture of which only about one Section (640 acres) will be affected by surface facilities related to the mining. There are no historic sites involved but about 13,000 acres of the area have been subjected to archeologic survey and 68 sites are recorded—a projection indicates that as many as 79 sites occur throughout the unsurveyed area. The Cedar Canyon Petroglyphs are a major archeological occurrence that is present. Just what the significance and hence the value is of this manifestation has not yet been determined. Therefore, they should enjoy as full a measure of protection as is possible. Of course it is recognized that with the increased population stemming from this and other area industrialization that vandalism, particularly pot-hunting, will increase. This is an impact that can only be mitigated, not just at the Long Canyon Mine, by the BLM providing increased protection.

The State Historic Preservation Officer (SHPO) has read with interest the proposals for mitigation of cultural values at the Long Canyon Mine and agrees with them wholeheartedly.

The proposed Black Butte Mine is the fifth, and final, Site Specific. About 19,000 acres, overlapping all the area to be mined or otherwise disturbed, of the total area of 26,800 acres have been archeologically inventoried. It is estimated that approximately 185 archeologic sites are within the total area. None have been found that were eligible for enrollment in the National Register of Historic Places. There is a possibility that one or more will be found that might be eligible. So far 39 sites have been found that will be destroyed by mining, 18 more sites are likely to be destroyed, 35 could be destroyed by mining proximity and 2 sites are within rights-of-way and presumably will be destroyed. But all of these sites have been investigated and found to be not significant in themselves.

The determination to have an archeologist present during all ground surface disturbance is insurance against a significant site being destroyed without knowledge. If a significant site is found, then due investigation will be made. Of course, it is only likely that such a site would be discovered because of the ground distrubance. The more ancient the site the more apt it is to be buried by deep formations and the less chance, except for the mining, that it would be found.

There are three historic sites within the area which are eligible for enrollment in the National Register of Historic Places. These are the Black Buttes Stage Station, Hallville and Gibraltar Mine. Also the corridor of the Overland Trail runs through the area. These have been declared eligible for National Register enrollment and 106 cases instigated to consider mitigation.

In general the State Historic Preservation Officer (SHPO) comments that this Draft Environmental Statement has given true consideration to the cultural environment, that historic preservation and, where necessary, mitigation measures are provided.

Sincerely,

Jan L. Wilson, Acting Director
and Wyoming State
Historic Preservation Officer
By:

Ned Frost

Ned Frost, Chief
Historical Division

JLW/NMF/mlr

Letter 22 Responses

1. Text revised (Black Butte, South Haystack, and Long Canyon, Chapter 4).

2. Land modification includes mining, surface facilities (buildings, haul roads, loadout facilities, storage facilities, overburden dumps), access roads, rail spurs, power lines, subsidence, pothunting, and recreational vehicle usage. Site specifics, Chapter 4, contain an appropriate mitigation measure to mitigate all incidences where subsurface sites may be encountered.

3. This is the purpose of the monitoring program as outlined in the site-specifics, Chapter 4.

4. This subject is covered in North Block, Chapter 4, Mitigating Measure 1.

5. Text revised (Twin Creek, Chapter 4, Mitigating Measure 2).

6. Text revised to reflect consultation with Advisory Council and State Historic Preservation Officer (South Haystack, Chapter 4, Mitigating Measure 3).

7. In this area the rail spur is on the old right-of-way. Any remains of the Oregon Trail have been obliterated by the old Cumberland Mine and its associated facilities. There are no good remains of the trail within at least a mile of this area.

8. Periodic monitoring will be conducted at the petroglyph site as indicated in Long Canyon, Chapter 4, Mitigating Measure 2. Protection is provided by impeding access to the site.

MAY 18 1978

23

THE STATE OF WYOMING

Ed Herschler, *Governor*

Leno Menghini, *Superintendent and Chief Engineer*

Wyoming State Highway Department

P. O. BOX 1708 CHEYENNE, WYOMING 82001

M E M O R A N D U M

May 17, 1978

TO: Steve Freudenthal, State Planning Coordinator
Wyoming State Clearing House
2320 Capitol Avenue
Cheyenne, Wyoming 82002

FROM: William P. King, P.E., Environmental Services Engineer *By HCH for*

SUBJECT: Review Comments on Development of Coal Resources in Southwestern Wyoming

General Comment

1 The Federal Highway Administration should be included as a participating agency so that proper documentation is included that will allow Federal-aid Highway Funds to be spent on highway improvements necessary to mitigate impacts of coal development without having to prepare an environmental statement for the highway improvement.

Specific Comments

2 1. Access roads are to be built for some of the mines. However, there is no mention as to whether these are to be private or public roads; and if public, whose jurisdiction they are to be under and who is to pay for them.

3 2. County roads are also to be used for access to the mines and will require early upgrading. Yet, there is no mention of who is to pay for them.

4 3. We are concerned about new railroad crossing of State Highways. The draft statement indicates that these are to be at-grade crossings. The Highway Department does not agree with this type of crossing; and will insist that they be separated crossings and that someone other than the State Highway Department pay for the crossings.

5

4. It is noted in the draft statement that the present U.S. Steel railroad spur causes severe problems in Rock Springs when in use by trains. Shipping coal on this line will only worsen a bad situation. There is no mention of investigation to determine if an alternative route exists that would bypass the community. We think that this investigation is imperative, and that the present spur line should be used only as a last resort. Coal train traffic may also require a separated crossing on U.S. 187 north of Rock Springs. This should be investigated further with the Highway Department.

5. A copy of this memorandum is being sent concurrently to:

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

WPK:lt

Letter 23 Responses

1. Text revised (Regional, Chapter 9).

2. While not committed as legally binding by the coal companies, it is assumed, through personal communication with mining company representatives, that mine access roads would be built, maintained, and paid for by the mining companies. The I-80 interchange for the Black Butte Mine would be paid for by the Black Butte Mining Company and would be the property of the State of Wyoming.

Access roads within the project area boundaries would be controlled by the mining company, as appropriate for safety and security purposes.

3. Representatives of the mining companies have indicated that, where county roads would be involved, the companies would provide for upgrading. This has not been committed to by the mining companies.

4. Where mining plans are indefinite about grade crossings, the ES assumed they would be on grade. Authorizations for railroads to cross state highways would be subject to Wyoming State Highway Department policy.

5. An alternative for either relocating the present U.S. Steel railroad spur or construction of a parallel line passing east or west of Rock Springs was not evaluated during the development of this ES. The railroad right-of-way, including the Evanston crossing area, was issued in 1910, while the right-of-way for the highway was issued in 1954, which included a right-of-way from the railroad to construct a crossing at Evanston. We agree that the railroad and the Highway Department might profitably investigate measures to improve this crossing.

24 Comment

At the public hearing in Kemmerer, Wyoming, Mr. Richard Jentzsch submitted a report titled Energy Impact System and Analysis, dated September 1977 and prepared by Lincoln-Uinta Association of Governments. This report is too lengthy to reproduce here; however, the following quote is taken from its introduction: "The study covers the present population and expected growth in employment and population. It also includes the public services required to keep up with this rate of growth. This can be done with potential grants and funds available through various governmental sources."

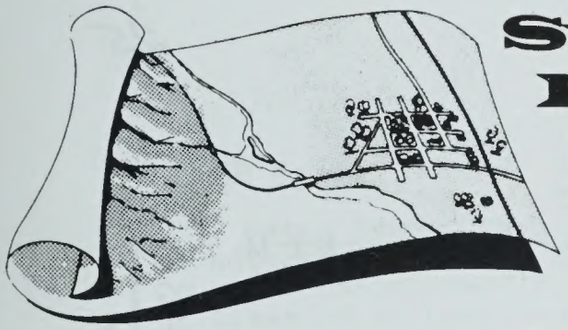
The entire report tended by Mr. Jentzsch at the hearing is on file at the Rock Springs District Office of the BLM.

Mr. Jentzsch appeared to be most concerned with the population figures in the draft ES as indicated by his comment: "Anyway, I think the basis of the population is what we would take exception to."

24 Response

The final ES contains revised population projections based upon the most recent information available. It is current as of January 1978. Differences in assumptions and modeling techniques would preclude any two sets of population projections from being exactly the same; however, it is felt that the revised Socioeconomic Conditions section contains reasonably accurate projections (see Regional, Chapter 4, and site-specifics, Chapter 3).

25



Sweetwater County Planning & Zoning Commission

P.O. Box 791
GREEN RIVER, WYOMING 82935

Telephone (307)
Green River, 875-2611 Ext. 42
or
Rock Springs, 362-7870 Ext. 42

May 16, 1978

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

The Sweetwater County Planning staff has reviewed portions of Volume I and those sections on the Proposed Long Canyon Mine and Proposed Black Butte Mine in Volume II of the Draft Environmental Statement - Development of Coal Resources in southwestern Wyoming.

The attached written comments reflect only the views and the opinions of the Sweetwater County Planning Department. We appreciate your consideration of our comments and hope you may find these comments beneficial.

Respectfully submitted,

Olena Buczacka

Olena Buczacka
Planner

OB/va

cc: John L. Yerkovich
Robert Volcic

RECEIVED
MAY 18 1978
B L M

25

COMMENTS

Draft Environmental Statement
Development of Coal Resources

RECEIVED
MAY 18 1978
B L M

I. General Comments

The draft Environmental Statement on Development of Coal Resources in Southwestern Wyoming mis-represents State Statute regarding the exercise of County zoning authority. Within these documents on pages R3-4, R3-7 of Volume I and LC2-21, BB2-34 of Volume II, a statement is found that "The County cannot effect planning or zoning control over any lands used in the extraction or production of mineral resources".

1 Indeed, State Statute reads ". . .no zoning resolution or plan shall prevent any use or occupancy reasonably necessary to the extraction or production of the mineral resources in or under any lands subject thereto (18-5-201)". Historically, Sweetwater County has not interpreted this clause as total exclusion of any County zoning authority.

Even in the 1972 County Zoning Resolution of Sweetwater County, Section 8.8 attempts to address "reasonable extraction" and your policy of a buffer along major traveled roads have added a further limitation on mineral extraction or production.

A significant weakness in these documents is noticed by the Planning staff. Despite the proximity of the two proposed coal mines to the Town of South Superior and the unincorporated areas of Point of Rocks and Reliance, these urban areas are only briefly mentioned and noted. The two large communities of Rock Springs and Green River were examined closely but the remainder of Sweetwater County was <u>almost</u> ignored.

There are additional areas contained within the documents which need revisions and further inputs. These areas include the following:

2 <u>Population</u> - - The population forecasts for Sweetwater County and its municipalities are too low and not acceptable. Recent announcements (Tenneco, Panhandle Eastern, etc.) by corporations and industry would necessitate some considerable revisions in the projections by Abt Associates. Also, certain private sectors appear to be ignored as in the case of the proposed coal mines in eastern Sweetwater County.

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MAY 18 1978

B L M

3 Water Resources - - These documents indicate no adverse impacts on the water resources of Sweetwater County. Unfortunately, appropriations for water for utilization by Long Canyon (which was not identified in this Draft) would have some impact on water quality in the Green River by reducing the amount of flow to dilute the recognized problems of phosphates and total dissolved solids.

4 Infra-structure - - The 1975 study by Bickert, Browne, Coddington and Associates on the Annual and Long-Term Surpluses (Deficits) would appear inadequate on the fiscal impacts on local governmental units in Sweetwater County. The re-examination of the premises of this study would probably reveal other deficiencies within the entire subject area of "SOCIO-ECONOMIC CONDITIONS"

II. Specific Comments

5 Page R3-7 - On Local Planning, the last paragraph should be changed from "variances are required" to "a zone change to an industrial zone is required for mining activities".

6 Page LC2-25 - Police and Fire Protection. The County Fire Warden has not been mentioned. The Sweetwater County Fire Warden works closely with Green River's Fire Department and may hire Rock Springs off-duty firemen. Usually, the Rock Springs Fire Department assigns two men and equipment within a 15 mile radius outside the Rock Springs corporate limits.

7 Page LC3-2 - Last paragraph on air quality should include South Superior as one of the more populated areas that may have higher background concentration level of TSP since it is located approximately 8 miles down wind from the proposed mine site.

8 Page LC3-19 - Population. Increase of population may also be expected in South Superior and vicinity. There is an existing unimproved access road to the proposed Long Canyon Mine site. County areas North of Rock Springs may be expected to have population increases directly related to the development of this mine.

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9 Page LC3-24 - Housing. The number of housing units associated with the increase of population especially north of Rock Springs may be higher than shown on Table LC3-10.

The proposed Long Canyon Mine underground operation and somewhat isolated location from the main highway and from larger population concentrations is not expected to create significant environmental impacts on vegetation, wildlife, or population.

10 Page BB3-6 - Visibility. The proposed strip mining activities of the Black Butte Mine adjacent to the I-80 should be raised considering the location of Point of Rocks and traffic along I-80 that may be adversely affected by dust from the strip mining activity.

11 The Rock Springs Airport has not been mentioned as a possible area affected by fugitive dust from the strip mining. The airport is located about 15 miles due west of the proposed strip mining site.

Page BB3.23a-Visual Resources. The Sweetwater County Planning and Zoning Commission follows a policy to discourage industrial activities closer than 1000 feet from I-80 and other major roads.

12 Page BB3-26- Transportation. No mention has been made related to provision and upkeep of access roads to the mine sites.

While the strip mining of coal must be done, strip mining should be mitigated by stripping small areas with all precautions to minimize air pollution that would be created by frequent winds in the direction of high population concentration northwest and west of the Black Butte Mine. Dust "bowls" in Rock Springs associated with construction work make the population aware of the consequences created by surface land disturbance.

Whatever the activities in strip mining may be, a clean-up of the area is a reasonable expectation regardless of the cost.

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The following suggestions relate to tables and figures within Volume II of the ES:

13 1. Page LC1-6, Figure LC1-2. Perhaps Range 105 West should be Range 103 West.

2. Page LC2-20, Table LC2-4 and Table LC2-5. Source of the data is not shown.

14 3. Page LC2-32, Table LC2-12. The Sweetwater County 1976 population figure should be changed from 33,310 to 38, 310.

4. Page LC2-22, Table LC2-6. Source of the data seems incomplete.

5. Page LC2-30, Table LC2-11. Source of the data is not given.

Letter 25 Responses

1. Text revised (Regional, Chapter 3, and site specifics, Chapter 2, Land Use Plans, Controls, and Constraints).

2. The Socioeconomic Conditions sections have been revised to reflect the most recent data (including population forecasts) available. The new base estimates for population projections are correct through approximately 1 January 1978.

3. Although SUNEDCO does have a water right on the Green River, officials of the company say there are now no plans to use this right at Long Canyon Mine to wash or mine coal.

4. The Socioeconomic Conditions sections have been revised to reflect the most recent data (including government finances) available.

5. Text revised (Regional, Chapter 3, Local Planning).

6. The county fire warden was contacted by the socioeconomic contractor (Abt Associates). No significant impacts were determined on this office.

7. The Air Quality sections have been revised to reflect more current data.

8. Population increases in areas other than major communities in Sweetwater County are grouped under "Balance of county" in all tables. The document has emphasized areas of significant impact; Rock Springs and Green River appear to be most heavily impacted.

9. The Socioeconomic Conditions sections have been revised to reflect the most recent data (including housing estimates) available.

10. This comment has been incorporated in the Regional, Chapter 4, and site specifics, Chapter 3, Air Quality section.

11. The Rock Springs Airport should not be impacted by the Black Butte Mine for two reasons: (1) the distance involved and (2) the fact that it's upwind of the prevailing wind direction.

12. No mention was made regarding upkeep of access roads in the mining plans. It is assumed, through personal communication with the mining companies, that the mining companies would provide upkeep.

13. Text revised (Long Canyon, Chapter 1).

14. The Socioeconomic Conditions sections have been revised to reflect the most recent data available.

26

REPRESENTING ALL DISCIPLINES OF FISHERY SCIENCE

American Fisheries Society

COLORADO-WYOMING CHAPTER

June 13, 1978

1320 Renshaw Street
Laramie, Wyoming 82070

6/16/78
1 RS 6/16
Lead Resp 1

Mr. Dan Baker
State Director
Bureau of Land Management
Cheyenne, Wyoming 82002

Dear Mr. Baker:

The Colorado-Wyoming Chapter of the American Fisheries Society has completed a review of the Draft Environmental Statement for Coal Development in Southwestern Wyoming. As you may know the Chapter and Society work toward resource development, conservation and protection. The Chapter offers the following comments related to the DES.

1 The scene conveyed in the report indicates varying degrees of destruction of the aquatic environment, depression of fisheries, and loss of streams. It seems that these losses are written off as necessary for coal development. The Chapter suggests that all interests, federal, state, and industry are charged with stewardship of the terrestrial and aquatic resources. There is certainly a demand for energy development but the demand and development should be accompanied by safeguards for the aquatic resource. Buffer zones established along streams and placement of mine spoils away from drainages would certainly lessen damage to the aquatic system.

2 There are references (page R4-11) to relocation of large natural waterways, obliteration of tributaries, and modification of waterways. The impacts of such modification are not mentioned but must be severe. Are there no safeguards which might be implemented -- buffer zones?

3 References to increased sedimentation are common and statements are made that some fish loss should be expected in the Ham's Fork River. Relative to the North Block Mine the DES assumes a 50 percent loss of game and non-game fish populations. This indicates the people of Wyoming must sacrifice a portion of a fishing legacy entrusted to their stewardship. There is no reason that coal development should place a mortgage on that legacy; a mortgage which indicates a loss of a substantial part of the resource. Placement of spoils piles away from flood plains of streams and establishing buffer zones would do much to prevent destruction of habitat.

4 The Chapter believes development of coal reserves must proceed but is confident that the search for and development of energy need not be as destructive as the DES indicates. The concepts of buffer zones and proper

26

location and disposal of mine wastes are not new. The Chapter sincerely hopes that these measures will receive consideration and will be implemented to allow energy development and the fishery resource to continue in harmony.

Thank you for your kind attention.

Sincerely,

Robert W. Wiley

Robert W. Wiley
President

RWW:kd
cc: Neil Morck

Letter 26 Responses

1. Though buffer zones are not specifically considered, the Hams Fork Protection Alternative (North Block, Chapter 9) has been developed to provide protection of the Hams Fork.

2. No perennial large natural waterways would be relocated. All drainage channels affected would be ephemeral streams that cross areas to be mined or would be temporarily used to convey runoff of other ephemeral streams.

3. The North Block mining and reclamation plan will be returned to the Kemmerer Coal Company for modification to conform with SMCRA of 1977. The Hams Fork Protection Alternative, presented in North Block, Chapter 8, is a viable alternative which would prevent spoil storage on the floodplain of the Hams Fork. Also, see the revised North Block, Chapters 2, 3, and 4, Water Resouces, Surface Water sections, in regard to alluvial valley floors. Impacts to the Hams Fork would not be allowed.

4. See response number 3.

27

ARCH MINERAL CORPORATION
500 NORTH BROADWAY
ST. LOUIS, MISSOURI 63102

TELEPHONE
(314) 231-1010

RECEIVED
MAY 15 1978
B L M

May 10, 1978

Team Leader
Coal Environmental Statement Team
P. O. Box 1869
Rock Springs, Wyoming 82901

RE: Comments on Southwestern Wyoming Draft Environmental Impact Statement (E.I.S.).

Dear Sir:

We have reviewed the draft environmental statement for development of coal resources in Southwestern Wyoming. Arch Mineral is especially interested in this regional analysis because of four pending preference right lease applications in south-central Sweetwater County near Beans Spring. The area of these lease applications totals 8,202 acres. The quality of coal is very desirable in light of electric generating facilities' increased need for compliance coal.

Arch's initial showing was submitted on June 14, 1977. Mine planning and evaluation continue at Arch with anticipation of operating here as soon as leasing, environmental studies, permitting and contract work is completed. Yet, with this obvious desire to commence coal mining in this area, absolutely no mention of these pending leases is made, in what purports to be a comprehensive regional analysis. 1

Although we realize that the E.I.S. team cannot commit the Secretary to additional leasing and that a site-specific analysis was excluded for this reason, it still seems that the B.L.M. has failed to take advantage of the investment in these documents to consider the proposed mining operations as part of the development of coal resources in Southwestern Wyoming. NRDC vs. Hughes, notwithstanding, the timelines for opening a mine in this area, after the preference right leases are granted and subsequent environmental work is completed, are clearly not so remote so as to exclude altogether pending operations with initial showings on file. Further, the possibility of opening a mining operation on state land, to be expanded once federal lands are obtained, is distinct and real. 2

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MAY 15 1978
BLM

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3 We urge the E.I.S. team to make the most of this regional assessment and take advantage of the considerable amount of information Arch has already submitted in the initial showing and to include some mention and analysis of these proposed mining plans as part of the Southwestern Wyoming coal reserves which will be developed in the foreseeable future.

We would be pleased to meet with you to discuss Arch's mining plans for the Beans Spring area.

Very truly yours,

Sheridan A. Glen

Sheridan A. Glen
Director of Environmental Affairs

SAG:ro

cc: Messrs. Gary Wicks
Paul Storrs

Letter 27 Responses

1. The Regional, Chapter 8, High-Level Scenario, includes discussion and analysis of ". . . the possible development of seven areas of interest, which include preference right lease application areas . . ." with existing development, proposed development, and potential development of coal resources within the region.

2. The initial showing, referred to as documents in the comment, submitted by Arch Mineral Corporation to the BLM as a part of the procedural requirement of 43 CFR 3521.1 are for consideration concerning the preference right lease application on file with the BLM. The initial showings were not and are not considered as mining and reclamation plans suitable for environmental statement preparation and on file with the USGS. Also, see response number 1.

3. See response numbers 1 and 2.

28

BLACK BUTTE COAL COMPANY

DISTRICT OFFICE:
OMAHA, NEBRASKA 68131
1000 KIEWIT PLAZA
AREA CODE:402-342-2052

MINE OFFICE:
POINT OF ROCKS, WYOMING 82942
P.O. BOX 98
AREA CODE: 307-362-5913

ADDRESS REPLY TO: Mine Office

June 14, 1978

Mr. Robert Armstrong, Team Leader
Southwest Wyoming Coal ES Team
Bureau of Land Management
P.O. Box 1869
Rock Springs, Wyoming 82901

Dear Mr. Armstrong:

Thank you for providing our organization with copies of the draft Environmental Statement for Southwestern Wyoming Coal Development. We appreciate this opportunity to review and comment on the document.

Our review has indicated that all potential impacts have been addressed and analyzed. However, we believe some technical and site specific errors do exist. We have attached our corrections and comments for your use.

It is appropriate at this point to re-emphasize Black Butte Coal Company's intentions. Since 1974, we have intensely monitored and inventoried the Black Butte mine site's ecological systems. This has been accomplished by on-site permanent personnel who have developed detailed information on the land and its resources. The result is a 13 volume mining and reclamation plan which has been reviewed and permitted relative to air, water and land quality by the Wyoming Department of Environmental Quality under regulations which are as stringent or more so than Federal regulations. In point of fact, every permit and approval necessary to the development and operation of the mine under federal and state laws has been obtained except one - the approval of the Secretary of the Interior. This, of course, has been delayed until completion of the Environmental Statement.

These permits were acquired through our constant efforts to provide as accurate and detailed information as possible to the agency involved. Throughout the permit process we have kept the U.S.G.S. and the Bureau of Land Management advised of the status of our plans and accordingly the original seven copies of the mining and reclamation plan as submitted to the U.S.G.S. have also been updated. Most recently, this process has included the addition of documentation to place our plans in complete compliance with the Surface Mining and Reclamation Interim Regulations. These additions have been distributed to all appropriate federal and state agencies.

We thank you for this opportunity to comment. You and your team are to be commended for the level of professionalism demonstrated in the draft statement.

Very truly yours,

BLACK BUTTE COAL CO.

James M. Wilson
Mine Manager

JMW/nal
Attachment

BLACK BUTTE COAL COMPANY
COMMENTS ON SOUTHWESTERN WYOMING
COAL DRAFT ENVIRONMENTAL STATEMENT
JUNE 14, 1978

28

These comments address three subject areas of the Southwestern Wyoming Draft Environmental Statement. They include the projected impacts on (1) Air Quality, (2) Wildlife Resources, and (3) "Editorial" comments.

1. Air Quality

The Southwestern Wyoming Coal Draft ES utilized computer emissions modeling to analyze the impacts on Air Quality of the planned coal mining activities. Black Butte does not object to this technique as an interpretive tool. However, the use of computer modeling as the sole decision-making tool is not advisable for the following reasons:

1

A. The majority of computer TSP modelling has been of a preliminary nature.

B. A well defined data base is not available for the prediction of TSP concentrations.

C. The inherent limitations of the computer programs in use today.

As an example, most programs today model wind erosion based on laminar air flow. In many surface mines, a strong case can be made that turbulent flow actually exists. From a close review of the Black Butte mine area topography, it is quite obvious that the surface is a series of ridges or hogbacks which lie approximately perpendicular to the prevailing wind. The variation in surface elevation is over 500 feet in adjacent areas. Consequently, the air stream is generally in a turbulent condition on the leeward side of the ridges, precisely where most mining occurs. Turbulent flow, by its nature, will carry less suspended particles thus accelerating the fallout of those particles. The condition is further borne out through observation of soil conditions on the lee side of the hogbacks by the presence of numerous Kandaly dunes. Consequently, in most cases, laminar flow models will tend to over estimate emissions.

2

The models also assume all emissions originate at or above ground elevation. This is not the case. Coal loading operations always occur below ground level. Generally, overburden shovel loading operations also occur below the original

ground elevation. It should also be recognized that a portion of any dragline excavation and spoiling also occurs below ground level. The models in use today do not allow for this provision.

Environmental Research and Technology (ERT), the Bureau of Land Management's air quality consultant, discuss the current state-of-the-art within the "Regional Technical Report for Southwestern Coal Development Environmental Statement-Climate and Air Quality Sections." ERT states,

"No attempt has been made in this investigation to evaluate the potential uncertainties inherent in the mining plans, although these uncertainties are recognized in those instances where the ultimate impact on annual emissions would be significant. Prediction methodology is, for the most part, not based on particulate sampling at prototype coal mines, but on empirical relationships developed for nonmining sources. Preliminary studies conducted at several western surface mines have indicated, in fact, that for some activities, such as aggregate storage or dragline removal of overburden, errors of an order of magnitude or more are possible.

Because of the serious limitations inherent in state-of-the-art emission factors, the fugitive emissions burdens estimated for proposed and projected coal mines in the southwest Wyoming ES region, along with subsequently derived particulate concentrations, are deemed to be of little or no value in assessing absolute impact in terms of compliance with existing air quality standards. The quantitative results should therefore be viewed as merely a device to be used in a comparative assessment of impact among different coal mines, scenarios, or subregions and for clues as to the appropriate priortization of mitigating measures."

In February, 1977, Black Butte submitted an application for a permit to construct a surface mine to the Wyoming Department of Environmental Quality-Air Quality Division whose standards (60 ug/m^3 annual and 150 ug/m^3daily), are more stringent than the federal standards. The Division stated in their permit application analysis, "Considering the state-of-the-art in regard to emission estimates from mining activities and dispersion modeling of fugitive dust emissions, the Division is satisfied that the modeling presented and the ambient particulate concentrations predicted are conservative estimates and that construction and operation of the mine will, in all likelihood, not cause violations of the ambient air quality standards."

Pursuant to the computer modeling and the Air Quality Division's review of Black Butte's planned operations, Division permit number CT-105 was issued to Black Butte Coal Co. on August 5, 1977. Permit CT-105 also stipulates "that all access roads and haul roads be treated or surfaced with asphalt, oil or other chemicals in addition to water to control fugitive dust emissions. All treated road surfaces will be maintained on a continuous basis to the extent that the surface treatment remains viable as a control measure." The permit further stipulates that authorized representatives of the Air Quality Division be given permission to enter and inspect the property, that an adequate application of a wetting agent be applied to the two run-of-mine coal stockpiles during stockpiling and reclaiming operations, that Black Butte establish an ambient particulate monitoring network, and that Black Butte will submit quarterly construction progress reports. Black Butte will comply with these stipulations and has notified the Air Quality Division that initial construction activities have begun on private lands.

2. Wildlife Resources.

3 Table BB3-9 gives the impression that by the end of the mine life there will be a direct habitat loss of 14,245 acres and indirect habitat loss of 64,103 acres. To put this table into perspective, a column should be added to the table which indicates the acreage relcaimed by the target years. The acreages in the Indirect habitat loss column also appear high. The potential also exists to improve habitat as a result of the permanent livestock/wildlife watering ponds. A clearer perspective may also be gained by adding a column which addresses this potential for habitat improvement.

4

5 Table BB3-10 also lacks perspective. For each target year, population reduction numbers are provided which would be a result of the proposed action.

To maintain perspective, a column should be added to each target year which would forecast the number of individuals which would die as a result of natural mortality. This column would clarify the wildlife population reductions. In addition, few antelope and birds will be killed by the proposed action. Consequently, the table portrays an indirect loss due to habitat movement and not a direct kill. This should be pointed out. With the addition of water through final impoundments, it is entirely conceivable that habitat may be improved and thus, a net increase in wildlife support realized.

6

The majority of wildlife impacts was based on the formula derived on page BB3-21 of the Draft Statement. The formula will estimate biotic potential for a given species, however, it should be noted that if the results are to be accurate, accurate fecundity rates and female densities must also be known. The formula is being misapplied at Black Butte for the following reasons:

7

1) The formula requires all disturbed lands within the permit area to be void of the species it is describing for the entire life of the mine, i.e., 30 years. This is erroneous. The development of the Black Butte mine pits will be sequential. As an example, Mine Area E will not be developed until 1999. Consequently, wildlife species dependent on Area E will not be affected until 1999.

8

2) The assumption requiring a closed population eliminates the use of the formula to calculate the biotic potential for antelope. The formula would require the antelope to be year-long residents whose needs are met entirely within the disturbed lands within the permit area. If a closed population existed, minimal fluctuation would be observed in population surveys. This is not the case. Aerial census have revealed as few as 27 antelope on the permit area and as many as 884. (See Federal Coal Lease W-6266 Annual Report, Appendix D-5-April, 1978) The population is clearly migratory and not closed.

9

3) The formula does not consider that revegetation and reclamation will be concurrent with the advancement of mining operations at Black Butte (See MRP, Volume 1, the Mine Plan). In other words, the formula should allow for habitat restoration as reclamation proceeds and the renewed wildlife use of the restored areas.

10

If biotic potential is to be calculated, the Statement should point out that the values obtained are too high and not realistic values when one analyzes the populations as they exist on the mine property (See MRP, Volume 4, Appendix D-5). The use of the formula is further discussed below by species.

Antelope. The section on antelope (Volume 2, page BB3-22) needs close evaluation. An initial loss of 900 antelope is an unrealistic figure. If this value is compared to the antelope Seasonal Use Areas (Figure D-5-9, Black Butte Coal Company Federal Coal Lease W-6266 Annual Report, Vol.3) a correlation can be made between density estimates and antelope distribution. The major effect on antelope will be created by the mining of Mine Area I and N. Area I is scheduled for mining around 1989 and Area N after that. Therefore, antelope in these areas will not experience an impact for the next ten years. Dividing the mine permit area into three parts indicates a limited antelope use north of the railroad and a higher use to the south and west. (Figure 1). Density estimates from 19 aerial census show the respective antelope densities per square mile to be .61, 2.95 and 4.46 in the mine permit area.

11

These existing population densities should be used to evaluate antelope impact. Also, few antelope will actually be killed by mining activities due to their mobility. Rather, the impact will come from a disruption of antelope habitat.

12

It should be noted that the density estimates given above should be considered average minimum densities due to the probability of not seeing some antelope during the aerial surveys. We believe the majority of the antelope were observed and recorded.

Songbirds. The last sentence in the paragraph on songbirds should read, "Using this assumption, the proposed mine would account for the movement for an estimated...etc." Few of these birds will actually be killed by the proposed action. To put these numbers into perspective, natural mortality numbers assuming no mining in the area, compared to indirect losses from habitat removal, should be given. Also, areas that have been reclaimed, which would provide songbird habitat, should not be used in the formula for calculating these indirect losses.

13

14

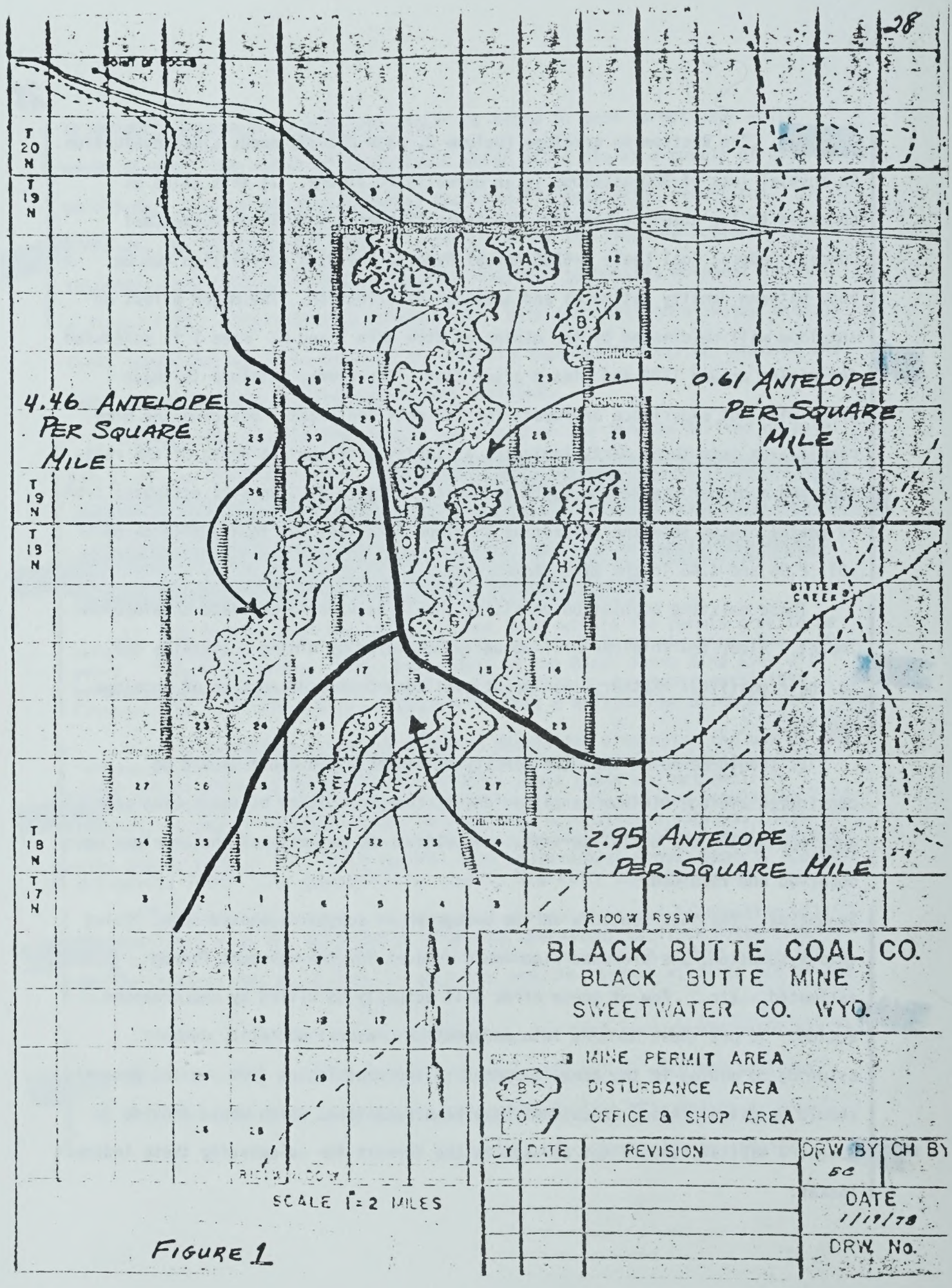
28
T 20 N
T 19 N
T 18 N
T 17 N
4.46 ANTELOPE PER SQUARE MILE
0.61 ANTELOPE PER SQUARE MILE
2.95 ANTELOPE PER SQUARE MILE
BITTER CREEK
R 100 W
R 99 W
BLACK BUTTE COAL CO.
BLACK BUTTE MINE
SWEETWATER CO. WYO.
MINE PERMIT AREA
DISTURBANCE AREA
OFFICE & SHOP AREA
BY
DATE
REVISION
DRW BY
CH BY
SC
DATE
1/19/78
DRW. No.
SCALE 1" = 2 MILES

FIGURE 1

Raptors. The first sentence of the paragraph on page BB3-21 of Volume 2 dealing with raptors should read, "There may be a loss of 29 raptor nests." 15 It should not be stated that all these nests will be abandoned. Sentence 4, 16 "Eighteen additional raptor nests...etc." should be treated in the same manner. The fifth sentence in this paragraph states that these nests "have potential to produce an estimated 88 birds in a given year." Three birds per nest per year is probably a high estimate and should be reduced to around 2 birds/nest/year. 17 (personal communication, Mr. Mike Lockhart, U.S. Fish and Wildlife Service). The yearly offspring is greatly influenced by the species of bird occupying the nest. Again, the 29 nests will not be disturbed the entire mine life.

Gamebirds. The section on game birds, specifically sage grouse, is misleading. No impact on sage grouse will occur until disturbance begins in Mine Area J. The majority of the grouse near Black Butte's mine permit area are believed to 18 be located on the first major ridge north of Patrick Draw Road (See MRP, Volume 4, Appendix D-5). This area is not included in the mine permit area. Limited use has been observed on the southwest portion of Mine Areas E and J. Natural mortality should also be addressed in the final environmental statement.

Non-game animals. The Draft ES lists the best population densities as 100 animals per acre in sagebrush and about 40 per acre in saltbush and greasewood. Black Butte data (See Federal Coal Lease W-6266 Annual Report, Appendix D-5- 19 April, 1978) indicates a density of 24.2 individuals per acre. This density excludes prairie dogs and other species that have a negative affinity toward snap and live trapping. Due to these high densities per acre, the acreage applied as the multiplier is very important. The actual acreage devoid of these 20 animals at any one time will be minimal due to concurrent reclamation and the speed at which these animals will repopulate a disturbed area. Natural

21 mortality numbers should also be given as well as population reductions due to mining to maintain a sense of perspective.

3. Editorial Comments

The following miscellaneous comments are based on Black Butte's review of Volume 2 of the Draft Environmental Statement. To facilitate your review, these comments have been organized by page number within the site specific portion of the Statement.

22 BB1-1. Black Butte's revised MRP was filed February 14, 1977. In other places of the text, the Statement infers that Black Butte's MRP filed June 22, 1976 was not in compliance with 30 CFR Part 211. This is not the case. The 6/22/76 MRP was prepared and filed pursuant to 30 CFR-Part 211. The major difference between the 6/22/76 MRP and the 2/14/77 MRP are the production rates for coal removal: 5mm tons per year in the 6/22 plan and 6.6mm tons per year in the 2/14/77 plan.

23 BB1-7. Black Butte does have a coal lease in Section 16, T19N, R100W. However, the surface in this section is federally owned and hence a right-of-way application for the haul road has been filed with the BLM. The Statement indicates Black Butte does not have a coal lease in Section 16.

24 BB1-7. The location for the existing transformer should be Range 101 West of the same township and range. The Statement places the transformer in Range 100W.

25 BB1-7. The paragraph discussing how Black Butte's mine areas will be stripped does not mention Mine Area E. Area E will be mined utilizing a dragline.

26 BB1-8. Pacific Power and Light Co's. captioned right-of-way application (W-52509) represents a right-of-way to provide Black Butte's operations with permanent electrical power at 34.5-kv. The proposed location parallels the existing Union Pacific Railroad's mainline transportation corridor.

27 BB1-11. The total acreage represented in Table BB1-5 includes the 109 acres approved by BLM for post mining livestock/wildlife ponds.

28 BB1-12. JN-4 drainage. Provisions within the MRP filed February 14, 1977 allow the JN-4 drainage to be diverted around the mining operation. Consequently, this drainage will not be impounded.

29 BB1-13. Regraded slopes. The vast majority of regraded slopes will exhibit a 5:1 slope or flatter (See MRP, Volume 7, Exhibits 11-18). Erosion control ditches will also be employed to minimize soil loss.

30 BB1-14. Topsoil depths will vary from approximately 11 inches on Mine Area L to approximately 32 inches in Mine Area D. See Black Butte's MRP, Volume 3, Appendix D-2, Soils and Land Use for more detail. The Statement states that six inches of topsoil would be laid and disced to prepare a seedbed.

31 BB1-14. The MRP discusses overburden disposal sites (boxcut spoils and initial truck shovel dumps). Boxcut spoil regrading will be complete within the time frame necessary to mine three turn-over cuts (See MRP, The Mine Plan, Vol.1). This time period will vary with each mining area, however should not exceed three years. Likewise, the initial truck-shovel dumps will be reclaimed as contemporaneously be possible. These time periods do not resemble "until almost the end of mine operations."

32 BB1-16. Water impoundments. The purpose of the impoundments is to facilitate increased carrying capacity of livestock and wildlife within the mine permit boundary. Not only have the water impoundments been improved by the BLM, but have been thoroughly discussed with the Rock Springs Grazing Association, who strongly recommended carrying out the plan. In addition, the program was discussed with personnel of the Wyoming Game and Fish Department, the Wyoming State Engineer and Wyoming Department of Environmental Quality. All of whom responded positively. The Statement indicated the purpose of the impoundments was to settle suspended solids.

33 BB1-16. Surface Water Monitoring Plan. This plan has been submitted to the United States Geological Survey and the Wyoming State Department of Environmental Quality pursuant to 30 CFR 715.17 (b).

34 BB1-20. Black Butte has also received, in addition to groundwater rights, surface water rights for its planned operations. These include water rights and priority dates for the eight permanent water impoundments.

35 BB2-27. The Overland Trail is discussed in conjunction with Sightseeing. It needs to be pointed out, however, that all traces of the Overland Trail within the permit boundary have been obliterated by the county road and the Union Pacific Railroad which was constructed in 1869.

36 BB3-12. Gullying as a result of construction of roads, railroads, utility lines, pipelines and powerlines would not constitute a significant impact since these facilities will be constructed in accordance with sound engineering design.

37 BB3-14. Drainage from all disturbed areas at the Black Butte Mine will be controlled. Current laws and regulations require that discharges from the mine area not exceed 35 mg/l daily average nor 70 mg/l at any time. The Statement indicated that "sediment discharge from the project area would increase during and after the mining reclamation, thus increasing the sediment load in Bitter Creek." This is highly unlikely. Under normal premining runoff conditions, Bitter Creek carries up into the thousands of milligrams per liter (mg/l) of suspended solids.

38 BB3-17. Fish will not be lost. The words loss of "fish and wildlife" are interspersed throughout this section. This is a falseimpression and reference to loss of fish should be removed.

BB3-22. Archaeological. The area to be disturbed by the Black Butte Mine has already been intensively surveyed, sites identified and mining impact on those sites mitigated. The impact identified in this section are probably overstated. However, Black Butte has made arrangements with Mr. Mike Metcalf, who performed

the original Black Butte archaeologic survey, to clear by trenching or augering the necessary Quaternary soils. Black Butte anticipates that this work will be complete by the end of August.

BB6-1. As clarification, no protected or endangered nests will be among the four raptor nests which will be destroyed. Black Butte's Mine Plan has been modified to avoid any nests of endangered or protected species.

Letter 28 Response

1. Computer modeling is not the sole decision-making tool. While it is recognized that modeling techniques contain inherent limitations, their use along with other sources such as monitoring of existing mines, provide the best basis now available for predictive impact assessment. For example, existing surface mines in southwestern Wyoming have, in the recent past, recorded violations of the 24-hour and PSD regulations.

2. This problem is not unique to the modeling effort of this ES; however, the initial mixing volume assumption was used to offset some of the emission origin.

3. A column which indicates acreage reclaimed would be misleading, since the table quantifies loss of existing habitat, and reclamation would not replace this habitat.

4. Data are not available which would provide quantification of population increases because of habitat improvement in a mining area; therefore, such a column in Table BB3-9 of the draft ES would not be accurate.

5. Text revised (Black Butte, Chapter 3, Fish and Wildlife, discussion of mortality).

6. Text revised, (Black Butte, Chapter 3, Fish and Wildlife, discussion of population losses).

7. Text revised (Black Butte, Chapter 3, Fish and Wildlife, discussion of population losses).

8. Text revised (Black Butte, Chapter 3, Fish and Wildlife).

9. Text revised (Regional, Chapter 4, Fish and Wildiife, discussion of reclamation).

10. Text revised (Black Butte, Chapter 3, Fish and Wildlife, discussion of population losses).

11. Text revised (Black Butte, Chapter 3, Fish and Wildlife, discussion of antelope losses).

12. Text revised (Black Butte, Chapter 3, Fish and Wildlife, discussion of antelope losses).

13. The magnitude of the loss of small nongame birds would depend on the time of year the disturbance takes place. Disturbance during breeding season would be most detrimental, since virtually all suitable habitat is occupied by territorial males. Because these birds are highly territorial, most displaced birds would be forced into unsuitable habitat and would not survive.

14. See discussion of reclamation in the Regional, Chapter 4, Fish and Wildlife section.

15. Text revised (Black Butte, Chapter 3, Fish and Wildlife).

16. Text revised (Black Butte, Chapter 3, Fish and Wildlife).

17. The average fecundity rates were based on Bent (1919-1968). It is believed that the figure of 3 birds per nest is a realistic estimate.

18. The impacts to the sage grouse population were based upon the fact that the Wyoming Game and Fish Department identified the entire area as sage grouse yearlong range. An average density per square mile over the entire yearlong range was used, since no other density information was available. In addition, since the entire area is sage grouse yearlong range, the potential exists for the entire area to be occupied by sage grouse and mining would remove that potential for sage grouse habitation.

19. Text revised (Black Butte, Chapter 3, Fish and Wildlife, discussion of population losses).

20. Text revised (Black Butte, Chapter 3, Fish and Wildlife, discussion of population losses).

21. See discussion of reclamation in the Regional, Chapter 4, Fish and Wildlife section.

22. Text revised (Black Butte, Chapter 1, History and Background).

23. Text revised (Black Butte, Chapter 1, Support Facilities).

24. Text revised (Black Butte, Chapter 1, Support Facilities).

25. Text revised (Black Butte, Chapter 1, Proposed Mine Layout and Mine Sequence).

26. Text revised (Black Butte, Chapter 1, Support Facilities).

27. Text revised (Black Butte, Chapter 1, Proposed Mine Layout and Mine Sequence).

28. Text revised (Black Butte, Chapter 1, Watercourse Diversions).

29. The Black Butte mining and reclamation plan, Volume I, page 73, states that "All spoil from mining activities will be graded to a slope of no steeper than 3½:1." Therefore, it is felt the references in the text to "...not exceed 3½:1...," "...3½:1 or flatter...," and "...3½:1 or flatter..." are not out of line.

30. Text revised (Black Butte, Chapter 1, Reclamation, Reclamation Schedule).

31. Text revised (Black Butte, Chapter 1, Reclamation, Reclamation Schedule).

32. Text revised (Black Butte, Chapter 1, Water Impoundments).

33. Text revised (Black Butte, Chapter 1, Pollution Control Methods).

34. According to the Black Butte mining and reclamation plan filed with the District Mining Supervisor of the USGS on 4 February 1977, there were no surface water appropriations made to the Black Butte Coal Company. Also, the mining and reclamation plan only talks of use of well water in the Water and Waste Water sections on page 21 of the plan.

35. Text revised (Black Butte, Chapter 2, Recreational Resources, Sightseeing).

36. While it is understood that sound engineering practices would be used, it is possible that designs can be exceeded by natural events which could lead to gullying along rights-of-way.

37. Any added sediment caused by natural events beyond the capacity of the settling ponds could add additional sediment to Bitter Creek.

38. Text revised (Black Butte, Chapter 3, Fish and Wildlife).

29

CBE-7836

a CBE Comment

Southwestern Wyoming Coal

May 1978

citizens for a better environment

Suite 2610 / 59 East Van Buren Street / Chicago, Illinois 60605 / Administrative: 312-939-1984 / Research: 312-939-1530

aCBEComment

CBE-7836

Comments Filed with
U.S. Department of the Interior
on Behalf of
CITIZENS FOR A BETTER ENVIRONMENT
by
KEVIN GREENE
on the
Draft Environmental Statement
Southwestern Wyoming Coal
31 May 1978

Pursuant to the Notice in the Federal Register of April 7, 1978 (43 F.R. 14746, et seq.), inviting written comments on the Draft Environmental Statement for Development of Coal Resources in Southwestern Wyoming, Citizens for a Better Environment (CBE) hereby submits its comments on that document.

GENERAL CONSIDERATIONS

One objective of the Environmental Impact Statement (EIS) for the Southwestern Coal Region of Wyoming is to describe the socioeconomic impact of mining activities on the local population. While the draft EIS contains a considerable amount of information on socioeconomic conditions in the principal coal region, CBE believes that in the case of the Black Butte mining proposal a broader geographic study would reveal the potential for serious social and economic disruption beyond the Wyoming border.

BLACK BUTTE MINE

The Black Butte Coal Company proposes to supply approximately 6.3 million tons of coal per year to Commonwealth Edison Company of Chicago (hereinafter "Edison").

In 1976 Edison entered into an agreement with Idaho Power which gave Edison the right to purchase some or all of the coal under the Black Butte-Idaho Power contract. During the same year Edison entered into a contract with Black Butte to purchase additional quantities of coal from another mine on the same property.

Edison expects to receive coal under the Black Butte-Edison contract by October 1, 1979. Delievery under the Idaho Power contract is scheduled to begin eight months later. (See attached Answers to Intervenor's Third Set of Interrogatories, page 2.)

POWERTON STATION

One of Commonwealth Edison's coal-fired stations, Powerton, is a 1700-megawatt plant located near Pekin, Illinois. The station burns approximately 4.5 million tons of Illinois coal per year. The mines which presently supply the coal at Powerton are the Monterey Mine of Monterey Coal Company at Carlinville, Illinois, and the Captain Mine at Percy, Illinois. More than 600 miners are employed at these mines that serve Powerton.

Last March Edison informed both coal companies that it planned to meet state sulfur emission standards at Powerton through the use of low-sulfur coal. The coal will be supplied, in part, from the Black Butte Coal Company and Idaho Power (Answer to Interrogatories, pp. 2, 3, and 4).

LOW-SULFUR COAL AND POWERTON STATION

The substitution of western coal for Illinois coal at Powerton could cost more than 600 miners their jobs. Because of the possible displacement of local workers, Governor James R. Thompson of Illinois recently announced his intention to hold public hearings on the economic impact of the Edison decision to determine whether the company should be prohibited from burning out-of-state coal under Section 125 of the Clean Air Act of 1977.

This action by the Governor clearly underscores the serious nature of the switch by Edison to western coal at Powerton. CBE believes the U.S. Department of the Interior has the responsibility of investigating this matter in the course of preparing an EIS for the Black Butte mining operation. At the minimum, Interior should determine the exact relationship between Black Butte and Powerton in order to properly ascertain the impact of using western coal at Powerton and the control alternatives available to Edison to minimize local disruption in the Illinois coal basin.

CBE recognizes that many of these issues must be addressed on a national level in the EIS on the Federal Coal Leasing Program. (See Federal Coal Leasing Policy, CBE-7830, a Comment filed with the U.S. Department of Interior on 31 January 1978.) However, since the programmatic EIS will discuss these issues only in a broad generic sense, the proper forum for an assessment of a specific case should be the regional EIS. If the Powerton matter is included in the draft EIS, policymakers will be provided with an opportunity to review the full range of socioeconomic impacts resulting from the development of Black Butte coal.

In the past, the development of western coal fields has been highly dependent on the implementation and enforcement of sulfur emission standards east of the Mississippi River. There is little doubt that in many cases the use of western coal proved the most practical control method for older plants in metropolitan areas. But today, alternative control measures are available to the utility industry which could minimize the impact of achieving clean air goals while maintaining a healthy midwestern coal mining economy. CBE believes the Interior Department can no longer remain silent on this issue in instances where coal development on public land is at stake.

BEFORE THE POLLUTION CONTROL BOARD
OF THE STATE OF ILLINOIS

COMMONWEALTH EDISON COMPANY	)	
	)	
v.	)	PCB No. 77-201
	)	
ENVIRONMENTAL PROTECTION AGENCY	)	

NOTICE AND PROOF OF SERVICE

Barbara Sidler, Esq.
Air Pollution Control Division
Illinois Environmental
Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Michael R. Berman, Esq.
59 East Van Buren Street
Suite 2610
Chicago, Illinois 60605

Russell R. Eggert, Esq.
Assistant Attorney General
Environmental Control Division
188 West Randolph Street
Suite 2315
Chicago, Illinois 60601

Howard Thomas, Esq.
Hearing Officer
Lehmann Building
Suite 307
Peoria, Illinois 61602

PLEASE TAKE NOTICE that, on behalf of Commonwealth Edison Company, I have today filed in the Office of the Clerk of the Pollution Control Board "Answers to Intervenor's Third Set of Interrogatories", a copy of which is herewith served upon the above addressees this 10th day of May, 1978, by depositing same with prepaid postage affixed thereto with the U.S. Postal Service at One First National Plaza, Chicago, Illinois.

ISHAM, LINCOLN & BEALE

By _____
Attorneys for
COMMONWEALTH EDISON COMPANY

One First National Plaza
Suite 4200
Chicago, Illinois 60603
(312)786-7500

BEFORE THE POLLUTION CONTROL BOARD
OF THE STATE OF ILLINOIS

COMMONWEALTH EDISON COMPANY	)	
	)	
vs.	)	PCB No. 77-201
	)	
ENVIRONMENTAL PROTECTION AGENCY	)	

ANSWERS TO INTERVENOR'S
THIRD SET OF INTERROGATORIES

NOW COMES Commonwealth Edison Company, in response to the third set of interrogatories propounded by Intervenor, Citizens for a Better Environment, and for its answers to said interrogatories, Commonwealth Edison Company ("Edison"), by its Director of Environmental Affairs, J. P. McCluskey, being first duly sworn upon oath, states as follows:

Interrogatory No. 1

State the name of the coal company or companies that will supply low-sulfur coal to Powerton.

Answer No. 1

Edison ordinarily does not purchase coal for a specific station and its coal supply contracts ordinarily do not provide that a coal will be used at a specific station. Powerton may from time to time utilize any of several low-sulfur coals that the Edison system will receive

and that will have certain combustion characteristics. Edison expects at this time that Powerton will use coal that will be supplied to Edison by the following companies: the Big Horn Coal Company; the Black Butte Coal Company; the Idaho Power Company; and the Decker Coal Company. Edison also anticipates that Powerton will use coal that will be produced from a mine Edison itself owns in southern Wyoming.

Interrogatory No. 2

State the length of each contract with the coal company or companies that will supply low-sulfur coal to Powerton.

Answer No. 2

Contracts with companies whose coal may be used at Powerton extend as follows:

Company	Date of Initial Shipment	Expiration Date
Decker Coal Company	8-22-72	12-31-78
Big Horn Coal Company	11- 1-76	12-31-88
Decker Coal Company	7- 1-78[1]	12-31-97
Black Butte Coal Company	10- 1-79[1]	12-31-98
Idaho Power Company	6- 1-80[1]	12-31-84
Commonwealth Edison Company	Early 1980's[1&2]	None

1. Presently estimated
2. Dependent on date of federal lease

Interrogatory No. 3

State the total amount of low-sulfur coal that each coal company will supply to Powerton.

Answer No. 3

Edison cannot now determine what proportion of the low-sulfur coal to be used at Powerton will be supplied by each mine or company. The total amount of coal which each company is expected to supply to Edison in the future at a minimum is as follows:

Big Horn Coal Company	-	38,300,000 tons
Decker Coal Company	-	84 million tons
Black Butte Coal Company	-	60 million tons
Idaho Power Company	-	13,800,000 tons
Commonwealth Edison Company	-	200 million to 300 million tons

Interrogatory No. 4

State the amount of low-sulfur coal that each coal company will supply to Powerton on an annual basis.

Answer No. 4

Edison cannot now determine what proportion of Powerton's requirements will be supplied by each company. Powerton is expected to require approximately 4.3 million tons of low-sulfur coal annually. The minimum annual output from each of the contracts listed in Answer No. 2 is as follows:

Company	Annual Output
Decker Coal Company	6.6 million tons (1978)
Big Horn Coal Company	2,700,000 tons (1978) 8,000,000 tons (1979) 5,000,000 tons (1980) 4,000,000 tons (1981) 3,000,000 tons (1981) 3,000,000 tons (1982 and 1984-1988) 1,000,000 tons (1983)
Decker Coal Company	4 million tons
Black Butte Coal Company	3 million tons
Idaho Power Company	1.7 million tons (1980) 3.2 million tons (1981) 3.0 million tons (1982-1984)
Commonwealth Edison Company	4.0 to 6.0 million tons (time uncertain)

In addition, Idaho Power Company may continue to supply coal beyond 1984 in accordance with certain contract options.

Interrogatory No. 5

State the location of the mine or mines that will supply low-sulfur coal to Powerton, itemized by company, mine site, county, state, and amount of coal they will supply.

Answer No. 5

The amounts of coal to be supplied by each mine are included in Answers No. 3 and 4. The location and type of the mines that may supply coal to Powerton are as follows:

Company	Mine	County	State	Type of Mine
Big Horn Coal Company	Big Horn	Sheridan	Wyoming	Surface
Decker Coal Company	Decker Mine	Big Horn	Montana	Surface
Decker Coal Company	East Decker	Big Horn	Montana	Surface
Black Butte Coal Company	Black Butte Mine	Sweetwater	Wyoming	Surface
Idaho Power Company	Black Butte Mine	Sweetwater	Wyoming	Surface
Commonwealth Edison Company	unnamed	Carbon	Wyoming	Deep

One of Edison's contracts with Big Horn Coal Company provides that the supplier under certain limited circumstances may deliver substitute coal from other companies or mines. That substitute coal may also be used at Powerton. Edison cannot now identify those mines or companies from which that substitute coal may come.

Interrogatory No. 6

State the name of all railroads that will be involved in the transportation of low-sulfur coal to Powerton and which mines they will service.

Answer No. 6

The following railroads are expected to be involved in the transport of the coal that may be delivered to Powerton from the following mines:

Railroad	Mines
Burlington Northern Railroad	Decker East Decker Big Horn and substitute mines
Union Pacific Railroad	Black Butte Commonwealth Edison mine

Peoria & Pekin Union Railroad	all mines
Chicago & Ill. Midland Railroad	all mines

The above table may be incomplete insofar as intermediate carriers may be used or it becomes necessary to change routings.

Interrogatory No. 7

State the costs of transporting the low-sulfur coal that Edison plans to burn at Powerton in dollars per ton.

Answer No. 7

The costs of transportation for Big Horn and Decker coal are presently $12.69 per ton. The costs of transportation for Black Butte coal are expected to be less than $15.80 per ton, which is the cost of coal presently moving to the Chicago area from a nearby mine on a single-car tariff. The cost of transporting coal from Commonwealth Edison's Wyoming mine would be approximately $12.00 per ton at today's prices. All of the above costs are subject to escalation and will vary according to the actual quantities of coal shipped.

Interrogatory No. 8

State the total delivered price of the low-sulfur coal that Edison plans to burn at Powerton in dollars per ton and cents per million BTU.

Answer No. 8

Estimates of the current delivered costs at Powerton of the low sulfur coals that may be burned at Powerton and that are currently being received by Edison are as follows: Decker, $21.43 per ton, 112.79¢/MBTU; Big Horn, $27.56 per ton, 149.8¢/MBTU. The delivered costs of East Decker and Black Butte coals are expected to be comparable to the Big Horn price. The Idaho Power coal is expected to cost about $7.00 less per ton, or approximately 5¢ per MBTU less, than the Big Horn coal. Cost estimates are not yet available for the Commonwealth Edison coal.

Interrogatory No. 9

State the heating value of the coal that Edison plans to burn at Powerton.

Answer No. 9

The minimum heating values of the coals which may be burned at Powerton are as follows:

Mine		Minimum Heating Value
Decker	-	9,500 BTU per pound
Big Horn or substitute coals	-	9,200 BTU per pound
Black Butte	-	9,000 BTU per pound
Commonwealth Edison	-	approximately 10,000 BTU per pound
East Decker	-	9,200 BTU per pound

Letter 29 Response

1. This comment raises issues which are beyond the scope of this ES. It involves: (1) the supply of out-of-state coal for an Illinois power plant; (2) alternate control strategies for an Illinois power plant; and (3) the disruption of Illinois coal basin production and jobs.

Markets in Illinois are not totally dependent on coal from a specific western mine or region. There are numerous other possibilities within various western regions.

The coal programmatic statement (see below) will address possible east vs. west dislocations and general characteristics of coals from various regions for power generation.

Detail as to the coal programmatic is as follows: The Department of Interior will prepare and publish a draft supplement to the final coal programmatic EIS previously issued on 19 September 1975 that will discuss whether a new coal leasing program should be undertaken and, if such a program is found to be necessary, what types of leasing systems could be utilized. The supplement will respond to the significant issues raised in the comments received (closing date for comments was 19 January 1978), including previous comments received on the earlier draft and final coal programmatic EISs. The new draft supplement will specifically propose policies and procedures for government management of the federal coal program in an environmentally sound manner. When published, the draft supplement will be made available to the public and announced in the Federal Register. After that, public hearings will be held and additional comments will be requested.

Thereafter, the Department will prepare a new final coal programmatic EIS that combines and integrates the material in the draft supplement with the final EIS previously released in September 1975. After the new final EIS has been made available to the public, is announced in the Federal Register, and is on file with the Environmental Protection Agency for at least 30 days, the Secretary of the Interior will personally reevaluate the federal coal management policy based on the information contained in the new final EIS and will adopt a new federal coal management policy.

30

Cumberland Coal Company

One Thousand Kiewit Plaza
Omaha, Nebraska 68131

(402) 342-2052

May 25, 1978

Team Leader
Coal E.S. Team
P.O. Box 1869
Rock Springs, Wyoming 82901

Dear Sir:

We have read and reviewed the Draft Environmental Statement for the Southwestern Coal Region of Wyoming and submit the following comments and questions.

Water Resources

1. P. SH2-7. Groundwater, line 5. Northerly should be southerly.

1 2. P. SH2-7. Groundwater Quality, line 8. What parameter is this? T.D.S.?

2 3. Re: Twin Creek and South Haystack. The aquifer tests are not the same in volumes 1 and 2.

Wildlife

The use of some type of predictive tool in determining the numbers of wildlife which will be lost due to "disturbance" in the area is a desirable goal. However, the equation which is presented on page R4-25 and others, when used with the assumptions that accompany it, suggest only the grossest trends in the wildlife populations. It needs to be more sensitive to the dynamics of populations. The assumptions also need to be redefined. For example, the density of an animal population is important, but the density of breeding females is equally important in determining population levels for 5, 10 or 20 years in the future. Some expansion is needed on normal levels of population change, i.e. populations are not totally stable but rise and fall. The fecundity rate or some type of offspring production rate should be used rather than "turnover of populations."

3

4 Also, how can carrying capacity be measured in acres? Carrying capacity is the rate or numbers of animals that an area can support without stressing the animal population or the area. The measurement in this section (page R4-25) is habitat losses, which can be measured in acres.

Very truly yours,

CUMBERLAND COAL COMPANY

Jack Reed

Jack Reed

JR/hc

Letter 30 Responses

1. Yes, the parameter is total dissolved solids.

2. The tests are the same; however, the units used, gallons per day per foot and feet per day, are different.

3. Text revised (Regional, Chapter 4, and site specifics, Chapter 3, Fish and Wildlife, Fish and Wildlife Population Loss).

4. Carrying capacity cannot be measured in acres. The acreage is the area upon which carrying capacity would be lost, not the loss of carrying capacity.

31

Cumberland Coal Company

One Thousand Kiewit Plaza
Omaha, Nebraska 68131

(402) 342-2052

June 13, 1978

Mr. Robert E. Armstrong
Team Leader
P.O. Box 1869
Rock Springs, Wyoming 82901

Dear Mr. Armstrong:

In addition to the comments we submitted May 25, 1978 regarding South Haystack, enclosed are comments from Rocky Mountain Energy Company. RME has reviewed and commented on Twin Creek and Volume 1, Regional Analysis also.

Very truly yours,

CUMBERLAND COAL COMPANY

Jack Reed /JS

Jack Reed

JR/hc
Enc.

31

COMMENTS OF
ROCKY MOUNTAIN ENERGY COMPANY
ON
DRAFT ENVIRONMENTAL STATEMENT
DEVELOPMENT OF COAL RESOURCES IN SOUTHWESTERN WYOMING
(Regional Analysis-Volume 1)

1

1. Summary Page, Item 3A: This statement is misleading and should be modified to more accurately reflect the conclusion reached on Page R4-11; i.e. "At one site, Long Canyon, 3,680 acres... would be undermined and would subside, but the surface would not, in most places, be significantly disrupted. (emphasis added)

2

2. Summary Page, Item 3F: This statement is misleading and should be modified to reflect the conclusions reached on Page R4-3 - R4-10. The reader should be made aware that even though air quality would be lowered, concentrations of all presently regulated pollutants (including TSP) would be well within the NAAQS PSD increments and the Wyoming Air Quality Standards.

3

3. Page R1-1, First complete paragraph in the right hand column: The proposed method of insuring compliance with the initial regulations (30 CFR 700) promulgated pursuant to the SMCRA is burdensome and causes excessive administrative delays without any corollary benefits in environmental protection. The initial regulations of SMCRA are performance standards to be met by new operations on or after February 3, 1978, and by existing operations on or after May 3, 1978. The most timely and efficient mechanism to insure compliance with the performance standards required by the initial regulations is to incorporate the requirements into the approval by stipulation, not by returning the plan for modification and explanation of compliance methodologies.

4. Page R1-3, Under the heading "Twin Creek Mine (Cumberland Coal Company)" it should be noted that the January 25, 77 mining and reclamation plan is a revision of a plan originally submitted to the USGS in July of 1976.

5. Page R2-1, first complete paragraph in the right hand column. According to Table R2-1, the highest temperature observed in the vicinity of the region was 105°F, not 97° as stated.

6. Page R2-51, Table R2-23. It would be helpful if the sites listed were shown on a map and their proximity to the proposed mining sites identified.

7. Page R3-6. The last sentence in the right hand column under the heading "Public Health and Safety" should be modified according to RMEC's comment No. 3 above.

8. Page R4-1. The third paragraph should be modified according to RMEC's comment No. 3 above.

9. Page R4-12 and R4-13, Groundwater. The impact discussion for groundwater is overgeneralized. This section should identify specific impacts which can realistically be expected to occur as a result from the proposed mines in the region. Numerous possible impacts are mentioned without any effort to determine whether or not they are significant.

10. Page R4-18, fifth complete sentence in the left hand column. The impact identified in this sentence is unrealistic considering the erosion and sedimentation protection afforded through enforcement of the Wyoming Department of Environmental Quality, EPA and OSM laws and regulations.

31

11. Page R4-18. The first sentence of the second complete paragraph in the right hand column should be deleted. Current laws require that all drainage from disturbed areas pass through sedimentation ponds prior to discharge to a surface water course and that Total Suspended Solids in the discharged effluent not exceed 35 mg/l daily average nor 70 mg/l at any time. Sediment concentration in the stream flows will likely be reduced as a result of being fed by discharges of relatively clean water from the mine sedimentation ponds.

11

12. Page R6-1. This section should reflect that approval of the proposed actions would help meet the nation's short-term energy needs, which will allow time to develop alternative energy modes.

12

13. Page R8-1, third paragraph. A phasing or time sequencing alternative for approval of mine plans should not be included in the final statement unless the public has had an opportunity to review and comment on the details of such an alternative.

14. Page R9-2, Item 14. Rocky Mountain Energy Company is not a subsidiary of the Union Pacific Railroad Company. Rocky Mountain Energy Company is a subsidiary of the Union Pacific Corporation.

SOUTH HAYSTACK

13 1. Page SH1-4, fifth paragraph in the right hand column: Acidity is mentioned in both items (4) and (5). This is redundant and should be corrected.

14 2. Page SH1-6 - Dust Control: The use of covered conveyors and silos should also be mentioned in the section on dust control.

15 3. Page SH1-6 - Proposed Mine Layout and Mining Sequence: The description of the proposed mining does not coincide with the plan shown on Map SH1-2. This discrepancy should be corrected.

4. Page SH1-6 - Mining Procedures: Reference to Rocky Mountain Energy Company should be deleted. The mining and reclamation plan was submitted to the USGS by Cumberland Coal Company; hence, "Cumberland Coal Company proposes an open-pit, truck and shovel operation..."

16 5. Page SH1-6 - Topsoil Removal and Disposition: The meaning of the second sentence is unclear and should be reworded. Topsoil is removed prior to other operations (drilling and blasting for example) to prevent soil contamination. Removing topsoil immediately prior to disturbance of a particular area minimizes the time of disturbance to that area.

17 6. Page SH1-9 - Reclamation: The second sentence should be deleted. Section 510 of the SMCRA is a permit section applicable only during the permanent regulatory program - - not during the initial regulatory program. In addition, Page SH-3-10 states that "It is believed that the methods and procedures proposed... would result in successful reclamation of disturbed lands."

18 7. Page SH3-7 - Paleontology: On Page SH1-4, it is stated that "it would be extremely unlikely that fossil vertebrates would be disturbed by South Haystack mining." Page SH3-7 states : "Impacts to paleontological resources would consist of losses of plant, invertebrate and vertebrate fossil materials...". This apparent discrepancy should be clarified.

19 8. Page SH3-8 - Soils: It is probably true that the existing soil structure will be affected by removing, transporting and stockpiling the topsoil. However, it should be stated that the impact on soil productivity caused by loss of existing soil structure will be insignificant, since "in nearly all soils of the area (South Haystack) the surface horizon is less than four inches thick. The structure below the thin topsoil layer is weak in stability and in some cases nonexistent." This quote was taken from page SH2-5 of the site specific description of the South Haystack site.

20 9. Page SH3-17 - Hunting: It should be noted that "hunting use is generally light" (Page SH2-23) on the South Haystack site. Therefore, impacts to hunting should not be considered significant.

21 10. Page SH3-17 - Sightseeing: The statement that "The construction and mining in the area would cause adverse impacts to recreational sightseeing values due to restricted access" is misleading. Page SH2-23 states that "Most of the sightseeing use in the South Haystack project area is incidental as people travel U. S. Highway 189."

3.

22 11. Pages SH3-17 and SH3-18 - Livestock Grazing: Do the AUM's lost per year for thirty years consider the AUM's which will be added as a result of reclamation activities ?

TWIN CREEK

23

1. Page TCI-12, Reclamation-First sentence. "... coal mining operations will be required, as a minimum, to restore the lands affected to a condition capable of supporting the use which it was capable of supporting prior to any mining, or higher or better uses of which there is reasonable likelihood."

   The phrase "of which there is reasonable likelihood" should be defined.

24

2. Page TCI-18, Third paragraph from the top. "Seeding would be done between mid-October and the latter part of April."

   This indicates that seeding operations would be conducted through the Winter. The sentence should be changed to read during mid-October or the latter part of April.

25

3. Page TC2-20, Socioeconomic conditions. This section does not adequately address the infrastructure in the Kemmerer-Diamondville area (including frontier). Transient workers, associated with expanded oil and gas exploration activities, have increased the population of the Kemmerer area (personal communication, Dan Broyles, Chief of Police-Kemmerer). Problems associated with this type of growth and conflicting life styles should be addressed.

26

4. Page TC3-9, First two paragraphs. The first two paragraphs state that gullying might occur along the right-of-way for the road, telephone line, and railroad.

   Identification of this impact statement should be tempered with the fact that sound engineering practices will be employed.

27

5. Page TC3-10, Under the heading, Surface Water, the second paragraph, second sentence, states that "Storm runoff from the area of spoil and topsoil piles would result in rapid erosion and sediments transported to the main drainages."

   This is not true. Runoff from all disturbed areas must pass through a sedimentation pond prior to discharge. Discharge from these ponds must meet stringent effluent standards.

28

6. Page TC3-10, Second to last paragraph. Successful reclamation efforts in the general vicinity should include the revegetation work performed by Kemmerer Coal Company.

29

7. Page TC3-11, Under the heading Aquatic, the last sentence states that "Submergent plants tend to stabilize silt bars and create important shelter for trout (Banks et al, 1974).

This statement implies that trout occur in streams on the project area when in fact no fishery exists on the permit area.

30

8. Page TC3-11, Fish and Wildlife. Why are impacts upon fish resources (e.g. loss of fish habitat) discussed when in fact no fishery exists on the mine permit area or areas surrounding the proposed permit boundary?

31

9. Page TC3-15, Under the heading Wildlife, it states "Using this assumption the proposed mine would account for the loss of an estimated 4,000; 20,000; 24,000 and 80,000 birds by 1980, 1985, 1990, and end of mine life, respectively."

The "carrying capacity" of adjacent lands should be addressed since most of the wildlife will inhabit nearby areas and will not be lost. The true impact will be on adjacent lands. The ES indicates that all wildlife on the proposed mine area will be destroyed.

32

10. Page TC3-16, Under the heading Cultural Resources it states "These impacts may take place to both archaeological and historical sites in the region." (Emphasis Added)

This portion of the ES is suppose to be addressing site specific impacts.

33

11. Page TC3-18, Under the heading Sightseeing, it states "There would also be adverse impacts to zoological sightseeing due to the displacement of wildlife species.

Not all species of wildlife will be displaced because of mining activities. Many will stay in close proximity to the mine area.

34

12. Page TC3-20, Transportation networks-Second paragraph, second sentence. In this section it states that "During construction this would cause an inconvenience to the many people who use this highway."

Is this a true statement? What is the conclusion based on? The word "many" should be defined.

35

13. Page TC5-1, Under the heading Soils, it states "The removal of topsoil to excessive depth would in some areas contaminate the topsoil with salts." "Some soil compaction would occur as a result of machinery traffice during reclamation."

These are not adverse impacts which cannot be avoided.

36

14. Page TC5-4, Under the heading Aquatic it states "Increased sedimentation of the Hams Fork would occur if water retention structures failed. Additional sediment loads would raise turbidity levels. Turbidity excludes sunlight which is necessary for submergent plant growth. Submergent plants tend to stabilize silt bars and create important shelter for trout (Banks et al, 1974)."

If it rained for 40 days and 40 nights, the entire permit area would probably turn into a lake. The paragraph should be deleted, especially since submergent plants have not been described in the existing environment section and also since no fishery exists on the area.

37

15. Page TC5-4, Under the heading Recreation Resources, it states "This increased use would result in lowering the quality of the existing "primitive" type of recreation experience."

This statement implies that the area is considered primitive; however, the paragraph above states that recreational activities include hunting, sightseeing, and off-road vehicles. How do off-road vehicles create a "primitive type of recreation experience?"

Letter 31 Responses

1. Because this is a one-page summary, it is necessarily limited in scope.

2. Text revised (Regional, Chapters 4 and 5, Air Quality). On a completely regional basis, the NAAQS will not be violated. However, in the immediate vicinity of the mines, both the 24-hour and the PSD increments could be exceeded (see the site-specific discussions).

3. While it is not agreed the method selected for inclusion of the initial regulations (30 CFR 700) into the plans is any more or less burdensome than another method, the returning of the mining plans to the companies would allow each company, at its own pace, to modify its mining plan to achieve compliance with the initial regulations (30 CFR 700). In some plans, modifications may be minor, while in others a major modification may be needed for compliance.

The Secretary of the Interior considered several methods of approval for inclusion of the initial regulation 30 CFR 700 and selected the return of the mining and reclamation plans to the companies as his preferred approach for making any needed modification.

4. Text revised (Regional, Chapter 1, Twin Creek Mine).

5. Text revised (Regional, Chapter 2, Climate, Temperature).

6. To publish maps showing site locations would constitute an additional impact, since it might stimulate additional pothunting and vandalism in the area.

7. See response number 3.

8. See response number 3.

9. This discussion is generalized, because it considers regional impacts. The largest, most significant impacts will be from demands on municipal water supply and sewage disposal. Other impacts mentioned are of more than site-specific significance but somewhat less than of full regional significance.

10. It is not unrealistic to consider a worst-case situation. If the design is for a 10-year 24-hour storm, it is most probable that the sediment and runoff basin capacity will be exceeded during a 20- to 30-year mine life. The impacts of such a failure require assessment.

11. Any design can be exceeded by natural events, and thus sediment and runoff from mined areas will get to streams. While required sediment ponds will reduce sediment from water flows, some additional sediment would go into stream channels if storm events exceed the design capacity of the sediment ponds.

12. Text revised (Regional, Chapter 6).

13. Text revised (South Haystack, Chapter 1, Predisturbance Inventories and Analyses).

14. Text revised (South Haystack, Chapter 1, Dust Control).

15. Text revised (South Haystack, Chapter 1, Proposed Mine Layout and Mining Sequence).

16. Text revised (South Haystack, Chapter 1, Topsoil Removal and Disposition).

17. The comments were considered and revision of the final ES text not considered appropriate. The mining and reclamation plans will be returned to all involved mining companies for appropriate modification to conform with SMCRA requirements. Modification would not necessarily be needed to fulfill reclamation requirements but could involve other areas of environmental concern.

18. See South Haystack, Chapter 3, Paleontology.

19. Structure is important, even in thin topsoil layers, due to its influence on such conditions and characteristics as bulk density, aeration, heat transfer, and water movement. The loss of topsoil structure would result in a temporary loss of soil productivity.

20. It is agreed that hunting impacts are not significant on site, because there would be restricted access and displacement of wildlife. Most of the impact to hunting as analyzed in the ES concentrates on impacts due to increased populations recreating in the region.

21. It is agreed that most sightseeing use is by people who travel Highway 189; however, South Haystack, Chapter 2, Recreational Resources, Sightseeing, also talks of people traveling on the mine area. These people would be restricted from the mine area, thus restricting the

access for sightseers.

22. AUMs gained through reclamation activities were considered in the calculation of losses.

23. Text revised (Twin Creek, Chapter 1, Reclamation).

24. Text revised (Twin Creek, Chapter 1, Revegetation).

25. It is felt that these impacts are sufficiently and thoroughly discussed in the ES.

26. It is understood that sound engineering practices will be employed. Because of this, the word "might" rather than the word "would" is used in the statement.

27. While it is understood that sound engineering practices would be used it is possible that designs can be exceeded by natural events which could lead to gullying along rights-of-way.

28. Text revised (Twin Creek, Chapter 3, Vegetation).

29. Analyses of impacts or possible impacts attributable to the proposed action were not restricted to within the project area boundaries. Part of the proposed mining activity is within the drainage of the Hams Fork. The Hams Fork supports a fishery and lies to the east of the proposed Twin Creek Mine.

30. Text revised (Twin Creek, Chapter 3, Fish and Wildlife).

31. See Twin Creek, Chapter 3, Fish and Wildlife, last paragraph of the introduction to the Fish and Wildlife Population Loss section.

32. Text revised (Twin Creek, Chapter 3, Cultural Resources).

33. It is felt that all species for which people zoologically sightsee (i.e., deer, antelope, moose, etc.) would be displaced from the mine area.

34. The mine plan calls for a relocation of Highway 30 through the Twin Creek Mine area. Nothing was stated in the revised (January 1977) mine plan as to how this is to be done. It was assumed; therefore, that this would by a typical highway relocation with delays in travel time and travel over rough roads for all persons using the highway during the relocation period. The word "many" is hard to quantify due to the fact that it all depends on length of time for relocation, time of year, and many other factors.

35. Text revised (Twin Creek, Chapter 5, Soils). Variation in topsoil depth and existing stripping technology would result in the unavoidable adverse impact of mixing topsoil and subsoil (with high salt content) in some areas.

Existing reclamation technology would more than likely result in the soils in some areas being compacted more than would be desirable for

optimal water infiltration.

36. The existing environment discussion of vegetation was restricted to the project area. A portion of the areas proposed for mining are within the Hams Fork drainage. Storms exceeding the 10-year storm design of sedimentation ponds could result in additional sediment deposit in the Hams Fork.

37. The paragraph which mentions hunting, sightseeing, and off-road vehicles is referring to activities on the mine area. The paragraph which mentions the "primitive" type of recreational experience is referring to the southwestern Wyoming region as a whole, and that as a regional experience, it is felt that there is a "primitive" type of experience. See the Recreational Visitor Use Demand table, TC3-11A, in Twin Creek, Chapter 3, for the increased use which would lower the quality of the "primitive" type of recreational experience.

32

Defenders
OF WILDLIFE

June 14, 1978

Comments of Dick Randall, North central representative, Defenders of Wildlife, on the Southwestern Wyoming Coal EIS:

SOUTH HAYSTACK:

We believe the values of wildlife and wildlife habitat in this area outweigh value of coal that would be mined. No longer can we view the loss of a few raptor nests or a few strutting grounds as an isolated kind of impact. Cumulative impacts in Wyoming, past, present, and future, assure that wildlife numbers and habitat will decrease. Therefore, each new wildlife impact or habitat loss assumes a greater significance.

If coal is to be mined in this area we believe mining should ocurr at some date, far in the future, when it can be demonstrated that a need for more coal outweighs loss of this critical habitat.

LONG CANYON

1 Surface mining in the Long and Cedar Canyon areas should not even be considered. These canyon areas support large raptor populations, supply crucial winter range for elk, deer, and antelope, and in the past few years have become an important recreation area.

2 On "Map 1" you show a projected development of existing leases which might expand the Long Canyon mine into the Kilpecker Dunes area. This expansion was not even discussed in the "mine plan."

This omission portrays either a complete disregard for values other than coal, or an administrative goof that may render this portion of the EIS invalid.

Impacts from the Long Canyon Mine would include:

Loss of about 40 elk since their winter range would be eliminated.

3 Depending on amount of surface activity - less raptor nesting in the canyons. Two years ago my census of nesting raptors in Cedar, Long, and Pine Canyons included golden eagles, prairie falcon, red-tailed hawks, kestrels, great horned owls, one family each of burrowing and short-eared owls, ferruginous hawks, two familys of marsh hawks at the mouth of Cedar and Pine Canyons, and one pair of Swainson's hawks. During crucial nesting periods these areas should be off limits from mining activities.

4 Loss of a major portion of winter range will seriously impact the herd of about 400 mule deer that winter in the area.

5 Recreational opportunities will be greatly reduced.

When compared with the big mines (such as Black Butte) this mine would be a small producer, and yet would have a big impact on critical wildlife habitat. Wildlife evicted by this mine will not simply move to another area. All the other places are already in use. They will simply cease to exist.

6 Some impacts can be mitigated by restricting this operation to underground mining. Certainly, no surface mining should be permitted.

NORTH BLOCK

We would strongly recommend the "no action" alternative to the North Block proposal. At this time it is unknown if units 3 and 4 of UPL's power plant will ever be built. Coal from this mine was to supply these units. Let's wait to find if the coal is even needed.

7 Under the proposed mine plan,damage to the Hams Fork fisheries and aquatic community is almost assured. Plans should include confining all sediment and run-off to the mine property. A "closed-basin" system could allow for settling and pollutants could be removed from water discharged into Hams Fork. This is a very basic consideration and I can not understand why it was not included in the mine plan.

BLACK BUTTE and summation:

8 Reclamation in this arid part of Wyoming is far from being a proven science. Statements such as "rangeland can be reclaimed to support pre-mining grazing rates" is based on figments rather than facts. I have seen acres of crested wheat flourish in reclamation areas - with the help of straw mulching - irrigation - and ferilizer - but this revegetation has absolutely nothing to do with the re-establishment of native plant communities.

9 We believe that the usual "sloping and reseeding" is an easy-out for the mine companies. Reclamation must focus on creating a better habitat than is there today.

10 If one were to design a system where sheet erosion could prosper, you couldn't do better than the 4 x 1 slope ratio included in the mine plans. Restoration must include diversity. Slopes should be terraced, gouged, and pitted. This would allow water to accumulate in different places - lead to a diversity of plant life - minimize wind erosion - and enhance or create habitat.

11 Reclamation of mine pits that are filled with water should include introduction of aquatic vegetation to provide nesting habitat for waterfowl. Some of these pits will surely provide fisheries. Why do you confine reclamation to sloping and reseeding? A little creativity with expertise supplied by people whose thinking is not restricted by stock dividends would certainly assure that reclamation would mean more than just leaving a waterhole.

We believe that no mining permits should be issued until a site specific assessment has been made by Wyoming Game and Fish Department, BLM, and that these assessments be made available to the public for comment.

Sincerely,

Dick Randall

Dick Randall
North central representative
Defenders of Wildlife
Box 507
Rock Springs, Wyoming 82901

Letter 32 Responses

1. The proposed Long Canyon Mine would be underground. In reference to concern shown for the canyon areas, see letter number 37 (The Wilderness Society), response number 4. Wildlife impacts are also noted in the ES and will be considered by the decision maker.

2. The Long Canyon mining and reclamation plan, as proposed, does not include the Kilpecker Dunes area nor are there any proposals on file with USGS to expand the current Long Canyon mining and reclamation plan into this dunes area. In the future should there be any such plan filed for considering approval by the Secretary of the Interior, such a plan would be analyzed similar to the one currently on file with environmental impacts identified for consideration in the decision-making process.

3. Under the current mine plan, no impacts to raptors are expected in the Long Canyon/Cedar Canyon area. Also, see letter number 37 (The Wilderness Society), response number 4.

4. This subject is covered in the final ES, Long Canyon, Chapter 3, Fish and Wildlife section.

5. It is agreed that recreational opportunities would be reduced by increased demand degrading the "primitive" quality of recreational experience.

6. The proposed Long Canyon Mine would be underground.

7. Text has been revised (North Block, Chapter 4) in regard to a required sedimentation containment system and to requirements pertaining to alluvial valley floors. Discussions pertinent to alluvial valley floors are also presented in the revised North Block, Chapters 2 and 3, Water Resources, Surface Water sections.

8. It is recognized that mined-land reclamation in the semiarid west is not without problems. However, sound practices and principles which have evolved from rangeland revegetation research are applicable to mined-land reclamation. Native plant species can be established on semiarid mined lands. (See the site specifics, Chapter 3, Vegetation, for mined-land reclamation references and the Regional, Appendix D, References. These publications discuss native plant establishment on arid to semiarid mined lands.) The establishment of some native species is more difficult than some naturalized, introduced plant species because of such factors as seed dormancy and low seed viability.

9. Reclamation standards are defined by state and federal laws (see Regional, Chapter 3). Flexibility in the design of mined lands is needed on a site-specific basis. This would allow professional input into the specific requirements needed to enhance the habitat and, hopefully, would result in the creation of a better habitat.

10. The grading of slopes to slight and moderate steepness would result in topographical diversity. Such diversity would provide habitat for wildlife species. The mining and reclamation plans (see site specifics, Chapter 1) discuss surface manipulation treatments such as terracing and pitting to collect water for plant establishment. Ponds are proposed for post mining use at some of the mines. The ponds would be beneficial to wildlife and livestock.

11. The article "Strip Mine Ponds" by Louis Rockett in the May 1978 issue of Wyoming Wildlife indicates the tremendous natural potential of "just leaving a waterhole." Apparently it is possible for aquatic vegetation to become established once an aquatic environment is established. Mr. Rockett emphasizes the importance of shaping spoils to provide access to ponds on less than steep slopes and of establishing vegetative cover on topsoiled spoils.

33

FMC Corporation

Natural Resources Department
Box 750
Kemmerer Wyoming 83101
(307) 877 3916

May 30, 1978

FMC

CERTIFIED MAIL

Team Leader
COAL ES TEAM
P. O. Box 1860
Rock Springs, Wyoming 82901

Dear Sir:

FMC Corporation compliments the Coal ES Team for the work they have done in compiling the Draft Environmental Statement for Proposed Development of Coal Resources in Southwestern Wyoming. As you know, FMC operates the Skull Point Mine, which is included in the Draft Statement, and, therefore, we are concerned that the Final Statement is totally comprehensive. The following comments on the Draft Statement are submitted for your review.

1

1. Reference page R2-16: paragraph entitled "Air Quality"

   What is the basis for using 1975 Wyoming air quality for baseline conditions? What was the deviation between the baseline data and the 1976 air quality data? Is two years data adequate to establish baseline conditions?

2

2. Reference page R2-19: paragraph entitled "Horizontal Visibility From Airport Observation"

   The data used and basis for conclusion is not evident.

3

3. Reference page R2-19: paragraph entitled "Visibility Related to Ambient TSP Levels"

   Is the Charlson 1969 relation valid for the concentration levels under consideration? The average worst total particulate concentration values used to estimate the average annual visibility range is not evident. How often does the worst case condition occur?

4

4. Reference page R2-196: paragraph entitled "Fish and Wildlife"

   Is there a factual data base for the estimated losses or are these only best guesses. If facts are available they are not shown.

5

5. Reference page R4-3: section entitled "Impact on Air Quality"

   Detailed information on ERTAQ model employed to estimate ground level TSP concentrations not available in Appendix B. What

are limitations of dispersion evaluation? Is this model applicable to mine operation emissions? What is the accuracy of the calculations?

6. Reference page R4-3: paragraph entitled "Worst Case 24-Hour Impact on TSP Concentrations"

6 What is the basis for the 43 to 63 micrograms per cubic meter background concentration? Based on dispersion model limitations, what is the accuracy of the calculated total particulate concentraion of 48 to 83 micrograms per cubic meter estimate? What is the basis that these values are below the 50 micrograms per cubic meter NAAQS and Wyoming standards?

7. Same reference as Item 6

7 What is the basis for the emission data used in the model prediction?

8. Reference page R4-18: paragraph entitled "Surface Water Quality"

8 What is the basis for the assumption that the dissolved solids content would increase significantly as a result of mining and reclamation operations? Has impoundment and available treatment technology been considered in estimating the water quality? Are treated groundwater and run-off characteristics significantly different?

9. Reference page R4-25: paragraph entitled "Nongame"

9 Projecting numerical fish loss in the 50 miles downstream of the North Block, using the statement of "some sediment washed into the Ham's Fork" is not consistent. The projections were made on a worst case situation which is not a realistic approach.

10. Reference page R4-26: paragraphs entitled "Wildlife", "Birds" and page R4-27: paragraph entitled "Mammals"

10 It is assumed that the area not disturbed would not support any more animals and that the animals would not move; this is not even reasonable. Secondly, it assumes the total area and animals will be lost; it gives no credit for reclamation which could even increase forage production.

11. Reference page R8-4: paragraph entitled "Endangered and (or) Threatened Species"

11 The last sentence of this paragraph is not a correct interpretation of the Act. This sentence says no adverse impact will be allowed...under any circumstances. The interpretation of Critical Habitat as published in the Federal Register of April 22, 1975 (40 CFR 17764-17765) should be reviewed as the same

strict interpretation from the regulations is not evident. It is our interpretation that the habitat and (or) threatened species must be critical to the survival of the species before adverse impact is not allowed.

12. Reference page R8-14: paragraph entitled "Endangered and (or) Threatened Species"

12

Same comment as Item 11.

GENERAL COMMENTS

13 The main thrust of the Environmental Statement appears to be negative and directed toward the worst case situations. There are very little positive aspects addressed in the Statement. Volume 1, Chapters 5, 6, and 7, seemingly address every aspect of change only from the negative, worst case situation, while very worthwhile, positive aspects of change are given no mention.

Sincerely,

Alvin S Rangitsch

Alvin S. Rangitsch
General Superintendent
Skull Point Mine

Letter 33 Responses

1. The 1975 Wyoming air quality information was readily available, had already been analyzed, and no significant new pollutant sources were identified for 1976, which made the 1975 data valid for use as baseline. The deviation between the 1975-1976 air quality data is discussed in the Chapter 2, Regional Technical Report (ERT 1978a), on file at the Rock Springs District Office of the BLM. Two years of data may not be adequate to establish baseline conditions; however, state and federal agencies use one year of air quality information as their minimum criteria.

2. Text revised (Regional, Chapter 2, Air Quality, Visibility).

3. Visibility related to ambient total suspended particulate levels has been deleted from the Regional, Chapter 2. Horizontal visibility from airport observations has been expanded to more clearly address the question of visibility.

4. See Regional, Chapter 4, Fish and Wildlife, Fish and Wildlife Population Loss, for an explanation of how losses were estimated.

5. This reference to the ERTAQ model is no longer in the Regional, Chapter 4. However, a discussion of the ERTAQ model can be found in the Chapter 4, Regional Technical Report (ERT 1978a), on file at the Rock Springs District Office of the BLM. The significant limitations and (or) assumptions for dispersion are discussed in the technical report referenced above. However, a detailed discussion of the limitations of dispersion evaluation is outside the scope of this ES. Yes, the model is applicable to mine emission modeling. The accuracy of the calculations are on the order of a factor of 2 to 3.

6. These predictions are below the 150 $\mu g/m^3$ state and secondary NAAQS for 24-hour averaging periods. This typographical error has been corrected.

7. U.S. Environmental Protection Agency (EPA) accepted procedures were used in the calculation of emissions. The sources of information used to calculate emissions were (1) the revised mining and reclamation plans on file at the USGS office at the time this analysis began (an independent analysis was done to determine applicability and validity), (2) Chapter 1s of the ES, (3) personal contacts with the proposed action mines personnel, (4) EPA published guidance, and (5) in a few instances, as a last resort, the assumption of routine mining practices.

8. Ground-water and surface-water characteraistics are not significantly different. Impoundments will be used, but storms exceeding the capacity of the impoundments will cause discharge of silt and dissolved solids which have been increased by evaporation and the solution of suspended solids in the ponds. Flocculation is considered for use by some mines. Other treatment methods have not been considered but are not ruled out if required or needed.

9. Text revised (Regional, Chapter 4, Fish and Wildlife, discussion of fishery).

10. An area of habitat can support a certain number of animals. If that habitat is removed, the area has lost its ability to support that number of animals, even though the animals inhabiting the area move elsewhere. For the second part of the comment, see discussion of reclamation in the Regional, Vegetation and Fish and Wildlife sections.

11. Text revised (Regional, Chapter 8, No-Action Alternative and Low-Level Scenario, Fish and Wildlife, Endangered and (or) Threatened Species).

12. See response number 11.

13. Adverse and beneficial impacts of the proposed actions are presented in the Chapter 3s. Chapter 5s discuss only adverse impacts which cannot be avoided should the proposals be implemented. Chapter 7s are intended to convey only irreversible and irretrievable commitments of resources which would be involved in the proposed actions should they be implemented. The Chapter 6s should present both adverse and beneficial impacts. The texts have been revised.

34

STATEMENT

ON THE

DRAFT ENVIRONMENTAL STATEMENT

DEVELOPMENT OF COAL RESOURCES IN SOUTHWESTERN WYOMING

PRESENTED BY

CLARK M. BOLSER

MANAGER OF ENVIRONMENTAL SERVICES

ROCKY MOUNTAIN ENERGY COMPANY

My name is Clark M. Bolser, I am the Manager of Environmental Services for Rocky Mountain Energy Company.

On behalf of Rocky Mountain Energy I would like to express our appreciation for this opportunity to comment today on the Draft Environmental Statement for Development of Coal Resources in Southwestern Wyoming.

As you may know, Rocky Mountain Energy is involved in the development of four (4) of the five (5) proposed mines being assessed by the Southwestern Wyoming Environmental Statement. Accordingly, we feel we have a particularly significant interest in the outcome of the actions that will be taken by the BLM and USGS, concerning these projects.

We would also like to take this opportunity to applaud the efforts of all individuals and agencies who have participated in the preparation of the Draft Statement. While the Statement may not be perfect in every particular we believe that it is a more than adequate discussion of the environmental setting and the associated impacts which may occur from

the proposed projects. We further believe that by this statement the requirements of the National Environmental Policy Act have been fully met.

We are in the process of preparing detailed written comments on the Draft Statement which we plan to submit in accordance with the Bureau's public notice of April 12, 1978. In this regard I might just say that we believe that the Draft Statement has a tendency to overstate impacts especially in the discussion on water quality, fish, wildlife, recreation and cultural resources. We would also urge that the Bureau and the Geologic Service not get bogged down in procedures extending the review of mine plans which will afford little if any additional environmental protection. Many of the performance standards required by the Federal Surface Mine Control and Reclamation Act and the Office of Surface Mining Interim Regulations can be adequately addressed by stipulation or by periodic review.

Rocky Mountain Energy is committed to the highest standards of reclamation and the protection of both the physical and human environment. My primary purpose today is to go on record as reaffirming RME's intention to see that these standards are maintained with regard to the projects we are involved.

This concludes my statement. Again, we appreciate the opportunity afforded us to make these comments today.

35

Southwest Wyoming Industrial Association

638 ELIAS
382-4190
ROCK SPRINGS, WYOMING 82901

May 26, 1978

Team Leader
Southwest Wyoming Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

Gentlemen:

With regard to the Draft Environmental Impact Statement on the development of coal resources in Southwest Wyoming, we would like to offer some specific comments with regard to Volume 1, "Regional Analysis". On Page R2-75 in the introductory paragraph "Health Care" you state that the Sweetwater County Priority Board identified health care as it's second priority for action behind housing. Actually, health care was the first such priority. 1

On Page R2-80 under the paragraph titled "Regional Mental Health Care" you failed to mention the Southwest Counseling Service based in Rock Springs which provides mental health service in Sweetwater County. The Jackson-based Mental Health Center mentioned in your narrative as serving the entire ES region serves only the Lincoln & Uinta County portion of it. 2

In discussing water systems on Page R2-86, you may wish to take cognizance of the fact that the water system for Rock Springs and Green River is owned and operated by Pacific Power and Light Company and not by those municipal governments. This same comment is applicable to Table R2-50 wherein you indicate that water improvement projects in the Green River and Rock Springs systems will need state and federal funds. We doubt that the private utility shall need or be eligible for such public funds. 3

35

4 With regard to Table R2-49 we believe your figure for water storage capacity in Rock Springs and Green River of one million gallons is grossly erroneous (low). The correct figure is surely available from Pacific Power and Light Company. Furthermore, in this same table your use of the word "inadequate" to describe the capacity of distribution systems is in itself inadequate. We would suggest that any inadequacies you believe exist should be identified specifically.

Overall the statement appears adequate. The importance of producing the coal under the reasonable impacts as shown in the draft statement can not be over emphasized and we hope the final statement can be published as soon as possible.

Thank you for the opportunity to provide these brief comments.

Yours truly,

Kim Briggs
Executive Director

KB/pm

Letter 35 Responses

1. Text revised (Regional, Chapter 2, Socioeconomic Conditions).

2. Text revised (Regional, Chapter 2, Socioeconomic Conditions).

3. Text revised (Regional, Chapter 2, Socioeconomic Conditions). Tables R2-49 and R2-50 have been deleted from the document. The most recent data available on water systems in the region are now available for review at the Rock Springs District Office of the BLM.

4. Table R2-49 has been deleted from the document. The most recent data available (including reasons for inadequacies) are now available for review at the Rock Springs District Office of the BLM.

36

THE KEMMERER COAL COMPANY

MINERS AND SHIPPERS OF ALL SIZES OF THE BEST STEAM AND DOMESTIC COALS

Frontier, Wyoming 83121

PHONE (307) 877-4458

ROY COULSON
PRESIDENT

May 25, 1978

Team Leader - Draft Environmental Statement
Southwestern Wyoming Coal
Bureau of Land Management
P.O. Box 1869
Rock Springs, Wyoming 82901

RE: North Block Mining & Reclamation Plan Revision

Dear Sirs:

Enclosed are revised Mining and Reclamation plan maps for the proposed North Block operation. The Kemmerer Coal Company would like to enter these plan maps into the May 17 Public Hearing Record as evidence upgrading the present Kemmerer Coal Company plans.

Thank you for your cooperation in this matter.

Sincerely,

D.L. Toberman, Manager
Reclamation & Environmental Engineering
Division

NB:jw

Enclosures

Letter 36 Response

1. The revised mining and reclamation plan maps received are considered as evidence of Kemmerer Coal Company upgrading the present plan on file with the USGS toward compliance with the Surface Mining Control and Reclamation Act (1977) and the Office of Surface Mining Regulations 30 CFR 700.

The Wilderness Society

P.O. Box 1184, Cheyenne, Wyoming 82001

Telephone (307) 635-3416

37

5/11/78

Dan Baker; State Director
Wyoming State Office
Bureau of Land Management
Cheyenne, Wyo. 82001

Dear Dan:

I'm sorry that I will be unable to attend your two Coal EIS hearings -- I will be attending Forest Service hearings on other matters in Washington, D.C. at the same time. Nevertheless, I wanted to present some comments on behalf of The Wilderness Society. As a preface, I'd like to say that the statements were clearly presented, and as comprehensive as any EIS I've seen.

COMMENTS

NORTH BLOCK

Our major concerns revolve around the serious potential damage to 50 miles of the important Hams Fork fishery which is a Class II fishery(of state-wide importance); and the potential loss of prime moose habitat.

The total predicted economic loss of fish and wildlife resources of about 1.3million dollars for the mine life period gives us great concern--the actions that would cause those losses are unacceptable.

1 I am not convinced that disturbed rangelands can be capable of supporting "pre-mining" livestock rates --simply because reclamation is not a proven science, especially in our dry southwest regions, and because this reclamation will require irrigation water. Has the company got the proper water rights?

----Alternative Action---

1. First we would recommend the "no action" alternative because there is no basis for approval at this time. The coal is supposedly going to supply units 3&4 of UP&L's Power Plant---those units may never be built.

2 2. If it becomes necessary to approve the mining plan, I would support a strengthened "Hams Fork Protection"alternative. I would add some additonal land to the south into sections 29 and 28 -- roughly corresponding with the area outlined as "scenery class B" shown in Appendix D. It is essential that we protect the moose habitat and prevent sedimentation damage to the Hams Fork.

SOUTH HAYSTACK

We are very concerned about the impacts on the "crucial breeding habitat of sage grouse" and two major strutting grounds. The potential loss of 5 raptors nests including a bald eagle's, plus the estimated loss of 500 raptors during the life of the mine is totally unacceptable.

The social impacts on Evanston from Oil and Gas activity are already a burden; I hope we don't add insult to injury.

37

LONG CANYON

3 One of the early statements concerning Long Canyon says it all....(Present and Future Land Uses)

"The land is used primarily for livestock grazing, wildlife habitat and outdoor recreation. Future use is expected to involve livestock grazing."

The mine's impacts will eliminate wildlife and outdoor recreation uses.

Our concerns are:

--nearby raptor nesting areas are in jeopardy
--40 elk and their crucial winter range will be eliminated
--we will lose a major portion of the prime winter range for 400 mule deer; lose a good portion of the herd, and lose important hunting opportunities in Pine, Cedar and Long Canyons.
--we are concerned about potential damage to the Cedar Canyon Petroglyphs, which are eligible for the National Register
--we are concerned about the loss of 737,538 dollars worth of wildlife resources
--your mitigating alternatives for wildlife are not good enough--it doesn't do much good to enhance habitat for wildlife that won't be there

---Alternative Action---

4 I'd like to suggest an alternative that would exclude surface activity in the area north of the Long Canyon-Cedar Canyon hydrographic divide. Indeed this would protect key wildlife values(elk,deer,raptors) archeological values and scenic values in the Cedar Canyon area and lands to the north. Cedar Canyon and areas to the north must be free of disturbances from the mining operation.

BLACK BUTTE

This mine looks like a lost cause--even though you can't prove reclamation. It seems that the 6.3 million tons/year could be mined and you could leave the other areas alone, since their production levels don't amount to much.

---

5 Finally, I am greatly disturbed that you don't mention the "projected development of existing leases"(shown on Map 1) in your discussions of each mine plan.

6 The projected expansions are potentially very damaging ---especially the possible expansion of the Long Canyon mining project into the Kilpecker Dunes area--between Boars Tusk and Steamboat Mountain. Such an expansion shows a callous disregard of other natural resource values.

Sincerely,

Bart

Bart Koehler/Regional Rep. The Wilderness Society

Letter 37 Responses

1. See the revised site specifics, Chapter 3, Vegetation sections, concerning mined-land reclamation within the region and in other comparable areas. Based on a review of reclamation literature, the resources presented in the site specifics, Chapter 2, and the proposed reclamation plans (subject to appropriate assumptions and guidelines in the Chapter 3s), it is believed that the proposed mined lands would be reclaimable and that the average annual forage production of the reclaimed lands would be capable of supporting premining livestock use.

Irrigation water would be obtainable under existing water rights and (or) from existing private sources. Other responses concerning irrigation are included in this section of Chapter 9. However, because reclamation success is dependent on site-specific conditions and the solving of problems either known or yet to be identified, a reclamation alternative is presented in the site-specifics, Chapter 8. Implementation of this alternative would result in the gathering of data to prove or disprove the reclaimability of lands proposed for mining. The reclaimed lands would have to be capable of supporting premining land uses, including livestock grazing.

2. Text revised (North Block, Chapter 8, Hams Fork Protection Alternative).

3. Future use would involve livestock grazing, wildlife habitat, and outdoor recreation. The text have been revised.

4. Text revised (Long Canyon, Chapter 8, Surface Facility Relocation Alternative). In reference to archeological values, see revised Long Canyon, Chapter 4, Mitigating Measure 3.

5. The possibility of further development of existing leases is analyzed in the Regional, Chapter 8, High-Level Scenario section.

6. Expansion of Long Canyon, an underground mine, is not expected during the time period, through 1990, covered by this ES. If expansion of the Long Canyon mining and reclamation plan to develop the Killpecker Dunes or any other area would be proposed by the mine company, the plan would have an additional environmental analysis done prior to mine plan approval. Such an analysis would include identification of impacts to all resources, including the Killpecker Dunes area.

38

UNION PACIFIC RAILROAD COMPANY

1416 DODGE STREET OMAHA, NEB. 68179

VALERIE W. SCOTT
General Planning Counsel

Initial

Lead Resp.

May 5, 1978

Mr. Daniel Baker
State Director
Wyoming State Office
Bureau of Land Management
2515 Warren (Lea Building)
Cheyenne, Wyoming 82001

Dear Mr. Baker:

Enclosed are Comments of Union Pacific Railroad Company on the Draft Environmental Statement on proposed coal development in the Southwestern Wyoming region.

As requested, Union Pacific is also providing more detailed data on present and projected traffic and various maps illustrating the characteristics of rail line in the system. This will follow shortly.

I hope the comments and data will be of assistance.

Very truly yours,

(Mrs.) Valerie W. Scott
(402) 271-4583

Enclosure

cc: Mr. James Lambert
Mr. Neil S. Morck
Mr. Francis D. Eickbush
Mr. Paul Kimberling
Mr. Stephen E. Berg-Hansen

38

RECEIVED

MAY 8 1978

B L M

Omaha - May 5, 1978

E-4301

Comments of
Union Pacific Railroad Company
Draft Southwestern Wyoming Coal Development
Environmental Statement
(Regional Analysis - Volume 1)

1 1. As a general comment, the Environmental Statement would be improved by more detailed analysis of reasonably foreseeable environmental impacts along railroad lines due to increased transport of coal to markets outside the region.

2 2. Summary, Item 3.0. As a summary statement, the second sentence overemphasizes delay of road traffic by increased rail traffic. The impact analysis (See Pages R4-32 to R4-34) does not appear to support such a strong statement. Certainly delays will occur, but increases should not be "especially significant". The second sentence should be deleted as the first sentence adequately and accurately summarizes impacts from railroad transport of coal from the region.

3 3. Page R1-3, Twin Creek Mine. Market areas for the Twin Creek Mine should be made consistent with those stated at top of Page TC1-3 and in Table R1-2 at Page R1-6.

4 4. Page R1-4, Table R1-1, Map Ref. No. 2, the Twin Creek Mine. Approval of federally owned right-of-way for a Railroad lead track to serve this mine is not needed. The necessary grant was made by the BLM in No. W52868, April 28, 1976. This will change the total number, miles and acres of railroad spurs at the bottom of the table.

5 5. Pages R1-4 and R1-10, Tables R1-1 and R1-3. The figures for miles of new railroad should be rendered consistent. In particular, the reference in Table R1-3 is forty to fifty miles of new railroad over the period whereas in Table R1-1 the reference is 38.8 total miles of railroad spurs. If the difference arises because different situations are being expressed, this should be clarified.

6 6. Page R1-6. Figures for existing trains are available.

38

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MAY 8 1978
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7 | 7. Page R1-13, Assumption No. 6. Depending on circumstances of railroad service along any particular line at the time a mine ceases operations, removal of track may be legally precluded. This would occur if continued operation along the line in question were necessary in fulfillment of the railroad's obligations as an interstate commerce carrier under the Interstate Commerce Act. In that case, railroad right-of-way could not be reclaimed at that time.

8 | 8. Page R2-63, section entitled Railroads. References to average number of trains, capacity and percentages of capacity are overgeneralized and insufficiently related to specific segments of rail line in the region. This should be amended to incorporate more detailed information on the different line segments in the region. In addition, the reference to the Oregon Shortline should be deleted to avoid confusion. The Union Pacific main line is divided into three districts: the Eastern District from Council Bluffs, Iowa, and Kansas City, Missouri to Ogden, Utah; the South Central District from Ogden, Utah, to Los Angeles, California; and the Northwest District from Granger, Wyoming, to Seattle, Washington. The Northwest District main line branches from the Eastern District main line at Granger to Kemmerer, Pocatello and the Northwest. Traffic projections, capacities and percentages must be sensitive to this division.

9 | 9. Page R2-86, section entitled Attitudes and Expectations. In our view these statements contribute absolutely nothing to this ES. There is no substantive documentation on the statements and, probably, the entire study would be best served by deleting them. If the section is to remain, focus should center upon objective indications of attitudes such as family size, population changes, crime rates and the like and related subjective reaction expressed in, for example, case load changes in counseling centers.

10 | 10. Page R2-100, second paragraph. The Railroad does not need clinker for its construction purposes.

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11. Page R2-100, section entitled Transportation Networks. The reference to current Union Pacific Railroad capacity should be deleted. This section should be amended as appropriate to incorporate more detailed information on the different rail line segments in the region, so that traffic projections and capacities are related to specific segments.

11

12. Page R3-5, first paragraph in right hand column. The first sentence would be more correct if it was as follows: "BLM is responsible for authorizing use of public lands by various ancillary facilities such as access power lines, communication lines, and railroad spurs."

12

13. Page R4-28, sections entitled Archaeology and Historical. It would be very helpful to have maps to the extent available showing locations of historical and archaeological sites in the area of coal and coal-related developments.

13

14. Page R4-34, the last sentence of the paragraph continuing at the top left column of R4-34. The words "an inestimable number of" should be deleted.

14

15. Page R4-34, third full paragraph. Figures on average number of trains, capacity and percentages of capacity are overgeneralized and insufficiently related to specific segments of rail line in the region. The section should be amended to incorporate more detailed information on the different line segments in the region.

15

16. Page R5-2, third full paragraph. Use of a map locating the threatened archaeological sites in relation to proposed activities would be helpful.

16

17. Page R5-2, the last paragraph in the left hand column carrying over to the top of the right hand column. The claim that inconvenience and "poor travel conditions" would result from relocation of roads and construction of railroad spur lines is vague at best and probably exaggerated. The reference to Table R1-1 is of little assistance in depicting actual impact of road relocation and railroad spur line construction.

17

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18 18. Page R5-2, first full paragraph in the right hand column. References to numbers of trains, capacity and percentages are overgeneralized and insufficiently related to specific segments of rail line in the region. This paragraph should be amended to incorporate more detailed information as to traffic, capacity and percentages of capacity on the different line segments in the region.

19 19. Page R6-1, number 11. The reduction from classes II, III and IV to class V is unclear in that the differences are not specified. Brief definitions of the classes would help alleviate any problem.

20 20. Page R8-6, section entitled Transportation Networks. The information on capacity and number of trains is overgeneralized and insufficiently related to specific segments of rail line in the region. The section should be amended to incorporate more detailed information on the different line segments in the region.

21 21. Page R8-15, section entitled Transportation Networks. References to average number of trains, capacities and percentages of capacity are overgeneralized and insufficiently related to specific segments of rail line in the region. This paragraph should be amended to incorporate more detailed information on the different line segments in the region.

22 22. Page R8-22, Table R8-10. Figures for numbers of trains per day eastbound and westbound in 1980 are referenced "NA". Figures for these trains are available. Reference should be made to Table R1-2 at Page R1-6.

23 23. Page R9-1, Item 4 in the right hand column. Other information was supplied by Union Pacific Railroad Company in addition to that supplied by Mr. Grau. Mr. Grau's name should be deleted throughout.

24 24. Page R9-2, Item 14 in the left hand column. Rocky Mountain Energy Company is not a subsidiary of Union Pacific Railroad Company. It is a subsidiary of Union Pacific Corporation.

25 25. Page R9-2, Nongovernment Organizations. The Union Pacific Railroad Company should be added to the list of names of organizations from which comments have been requested.

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B L M

Omaha - May 5, 1978

E-4301

Comments of
Union Pacific Railroad Company
Draft Southwestern Wyoming Coal Development
Environmental Statement
(Site Specific Analysis - Volume 2)

26

26. Page NB1-4, section entitled Support Facilities. There is not any coverage of railroads, despite the fact that in Map NB1-2, Page NB1-11, a railroad is shown in the North Block site.

27

27. Page NB1-10, section entitled Authorizing Actions. The Bureau of Land Management would have to issue a right-of-way for any railroad as well as road, conveyor system and telephone line.

28

28. Page NB2-25, section entitled Railroads. First of all, reference to the Oregon Shortline should be deleted to avoid confusion. Next, analysis is not sufficiently specific to isolate effects on Kemmerer and, in fact, the traffic figure of 48 trains per day does not apply to the segment of track in the immediate Kemmerer area. The last sentence in the section should be deleted because it is not true. Reference to average number of trains is overgeneralized and insufficiently related to specific segments of rail line in the region. The section should be amended to incorporate more detailed information on the different line segments in the region.

29

29. Page NB2-31, section entitled Transportation Networks. Union Pacific Railroad upgrades its rail lines as the amount of traffic requires. The capacity of the segment of track in the Kemmerer area has not yet been approached, nor is it expected to be approached in the near term.

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30. Page NB2-35, Table NB2-13. Figures on construction employment without the North Block Mine in 1980, 1985 and 1990 do not match figures in Table NBA-2 located at Page NBA-4. The apparent inconsistency should be reconciled or explained.

30

31. Page NB4-2, section entitled Right-of-Way. The last sentence should read, "The lessee would follow natural contours insofar as practicable when constructing these facilities to reduce the number of cuts and fills", conforming with language on the same issue at Page BB4-2.

31

32. Page NB6-1, Item #13 under Short-Term uses. The parenthetical statement should be deleted.

32

33. Page TC1-7, section entitled Support Facilities. The project includes right-of-way for 1.8 miles rather than 0.6 miles of railroad spur. Right-of-way across Federal lands has been granted by the BLM in No. W52868, April 28, 1976. Appropriate changes in table TC1-2, Page TC1-8, should be made as necessary.

33

34. Page TC1-7, section entitled Railroad Spur. There is reference to a map TC1-2, however no such map appears in the volume. Secondly, the surface owned by the United States is not limited to the south 1/2 of section 9 but also extends into the north 1/2 of section 9. Here again, appropriate changes should be made in table TC1-2. Finally, switch positions of Union Pacific and Oregon Shortline in the parentheses.

34

35. Page TC1-21, section entitled Bureau of Land Management (BLM). Please refer to two previous comments, numbered 33 and 34, regarding miles of right-of-way, prior approval and location of right-of-way.

35

36. Page TC2-20, section entitled Railroads. First, reference to the Oregon Shortline should be deleted to avoid confusion. Next, as to traffic capacity and description of Union Pacific line, please refer to comment numbered 28 above on text at Page NB2-25. Similar comments are applicable here. In addition, the reference to map TC2-6 speaks of service of the coal mine and power plant at Elkol whereas the map does not show either the coal mine or power plant.

36

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37. Page TC2-26, section on Transportation Networks. This does not describe the transportation network as far as railroads are concerned. Rather it describes only use of roads and related factors in the area.

38. Page TC2-30, Table TC2-11. Figures on construction employment without the Twin Creek Mine in 1980, 1985 and 1990, do not match figures in Table TC-A2 located at Page TCA-4. The apparent inconsistency should be reconciled or explained.

39. Page TC3-9, section entitled Soils. In the third full paragraph in the right hand column, a reference to Table TC2-1 (at page TC2-7) seems to be mistaken as the information in the table does not relate to the text at page TC3-9.

40. Page TC3-20, section entitled Transportation Networks. The information on average number of trains per day does not apply to the segments of line in this area. References to capacity and percentages of capacity are overgeneralized and insufficiently related to specific segments of rail line in the region. The percent of increase must be tied to specific track segments, as it will vary from place to place along the track. This arises because coal will be travelling both east and west, and therefore, specific differentiation will be necessary.

41. Page TC4-2, section entitled Rights-of-Way. The last sentence should read, "The lessee would follow natural contours insofar as practicable when constructing these facilities to reduce the number of cuts and fills", conforming with language on the same issue at Page BB4-2.

42. Page TC6-1, Item #7 under Short-term uses. The parenthetical statement should be deleted.

43. Page SH1-1, first paragraph. Cumberland Coal Company is not a subsidiary of Union Pacific Railroad. Rather, it is a joint venture of Rocky Mountain Energy Company and Peter Kiewit & Sons Co.

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44. Page SH2-30, section entitled Railroads. The first sentence in this section mentions that the nearest railroad service is six miles east of the mining area. This is factually accurate. However, it does not adequately describe the physical difficulty in dealing with railroad construction in this area due to "The Hogsback" (see Map 13, Appendix A). Because of the physical difficulties, the proposed spur will have to be substantially longer than would appear to be necessary from maps in the DES. Also, since the coal will be marketed in the Northwest, and the line referenced leads to the Southwest, it would be less practical to build the spur to it than to Kemmerer. Either this six miles reference should be deleted or topographical problems should be more thoroughly described. A corresponding change may be added in the Operational Alternatives at Page SH8-1. In addition, more detailed information related to specific main-line segments should be included in this section.

44

45. Page SH2-37, section entitled Transportation Networks. This does not describe the transportation network as far as railroads are concerned. Rather, it describes only use of roads and related factors in the area.

45

46. Page SH2-42, Table SH2-21. Figures on construction employment without the South Haystack Mine do not match figures in Table SH-A2 (Uinta County) located at Page SHA-6. The apparent inconsistency should be reconciled or explained.

46

47. Page SH3-19, section entitled Transportation Networks, beginning with the third paragraph. Reference to average number of trains does not apply to the segments of line in this area. Information on capacity and percentages of capacity is overgeneralized and insufficiently related to specific segments of line in the region. Appropriate amendments should be made to reflect more detailed information. Secondly, in the following paragraph, there is stated the need to construct 15 miles of railroad track, whereas in Table R1-1, the total need is correctly stated to be 25 miles with 12 miles over public land.

47

48. Page SH4-3, section entitled Rights-of-way. The last sentence should read, "The lessee would follow natural contours insofar as practicable when constructing these facilities to reduce the number of cuts and fills", conforming with language on the same issue at Page BB4-2.

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49. Page SH5-5, section entitled Transportation Networks. In the last paragraph, if possible, the number and location of graded dirt roads crossed by the railroad spur should be specified. In addition, in the last sentence, the words "an inestimable number of" should be deleted.

50. Page SH6-1, Item #7 under Short-term uses. The parenthetical statement should be deleted.

51. Page SH8-1, section entitled Operational Alternatives. The comment on alternate sites for methods of coal transport could more specifically describe the alternative railroad lines proposed by the Union Pacific Railroad Company in data submitted to the BLM. One would connect with the Union Pacific main line at Carter, the other connecting with the Union Pacific main line near Kemmerer.

52. Page LC1-1, first paragraph in section entitled Predisturbance Inventories and Anaylsis. Cumberland Coal Company is described as consulting with the BLM on various specific inventories. Cumberland Coal Company is not associated with this project. The joint venturers are Rocky Mountain Energy Company and Sunedco.

53. Page LC1-4, section entitled Support Developments. The last sentence should read as follows: "The railroad spur would extend approximately seven miles easterly from the existing U. S. Steel railroad track, which extends from Winton Jct. to South Pass."

54. Page LC1-12, section entitled Relationship to Rail Transportation. The market areas are not consistent with those in Table R1-2, Page R1-6, nor with those at Page LC3-19. They should be reconciled.

55. Page LC1-12, section entitled Authorizing Actions. It is blank and should be completed.

56. Page LC2-23, section entitled Railroad. The last sentence should read as follows: "One daily unit train uses the track each direction hauling ore from South Pass to Winton Jct. where it is delivered to the Union Pacific for shipment to the main line at Rock Springs." In addition, more detailed information, related to the mainline segments through Rock Springs, should be added to this section.

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57 57. Page LC2-29, section entitled Transportation. This does not describe the Transportation Network as far as railroads are concerned. Rather it describes only use of roads and related factors in the area.

58 58. Page LC3-19, section entitled Transportation Networks. The directions of transportation of coal are not consistent with the indicated direction at Page LC1-12. References to average number of trains, capacity and percentages of capacity in the region are overgeneralized and insufficiently related to specific segments of rail line in the region. Appropriate amendments should be made to reflect more detailed information. In addition, the percentage in the third full paragraph should be corrected.

59 59. Page LC3-24, Table LC3-10. Please check the accuracy of the information presented in the Table. Specifically, note the large numbers in 1976. We assume 1976 is a base year, but clarification may be necessary.

60 60. Page LC4-2, section entitled Rights-of-Way. The last sentence should read, "The lessee would follow natural contours insofar as practicable when constructing these facilities to reduct the number of cuts and fills", conforming with language on the same issue at Page BB4-2.

61 61. Page LC5-5, section entitled Transportation. In the second paragraph, if possible, the number and location of graded dirt roads should be specified. In addition, the words "an inestimable number of" should be deleted from the last sentence.

62 62. Page LC6-1, Item #7 under Short-term uses. The parenthetical statement should be deleted.

63 63. Page BB2-2, section entitled Air Quality. Reference is made to Black Butte Mine Site and the total suspended particulates in Appendix B. Appendix B is located in Volume 1. An appropriate page reference would be helpful.

64 64. Page BB2-34, section entitled Railroads. References to capacity and percentages of capacity are incorrect.

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65 65. Page BB2-40, section entitled Transportation Networks. This does not describe the Transportation Network as far as railroads are concerned. Rather it describes only use of roads and related factors in the area.

66 66. Page BB2-44, Table BB2-24. Figures for construction employment without the Black Butte mine in 1980, 1985 and 1990 do not match figures in Table BB-A2 located at Page BBA-6. The apparent inconsistency should be reconciled or explained.

67 67. Page BB3-26 and 3-27, section entitled Transportation Networks. References to average number of trains, capacity and percentages of capacity in the region are overgeneralized and insufficiently related to specific segments of line. Appropriate amendments should be made to reflect more detailed information.

68 68. Page BB6-1, Item #10 under Short-term Uses. The parenthetical statement should be deleted.

Letter 38 Responses

1. Text revised (Regional, Chapter 4, Transportation Networks) to show impacts of trains, noise corridors, and air emissions outside the region.

2. Text revised (Regional, Summary).

3. Text revised (Regional, Chapter 1, Table R1-2) for consistency in market area.

4. This is still a BLM approval and should remain in the acreage disturbed column. Statement is footnoted to show that it has already been approved (Regional, Chapter 1, Table R1-4). Also, Text revised (Twin Creek, Chapter 1, Table TC1-2 and Facilities section). This railroad has not yet been constructed.

5. Table R1-1 is for impact data while Table R1-3 is baseline data without coal development, plus with coal development, plus high-level scenario.

6. The figures for existing trains on this table were felt to be not applicable rather than not available.

7. As of this time, there are no identified continued needs for any of the projected railroad spurs; so, this assumption has been used.

8. Text revised (Regional, Chapter 2, Transportation Networks) using new data provided by the Union Pacific Railroad Company.

9. This section is considered to have merit. The specific areas mentioned are covered in other Socioeconomics Conditions sections.

10. Text revised (Regional, Chapter 2F).

11. Text revised (Regional, Chapter 2F, Transportation Networks) to incorporate new data.

12. Text revised (Regional, Chapter 3, Institutional Relationships).

13. To publish maps showing site locations would constitute an additional impact, since this might stimulate additional pothunting and vandalism in the region.

14. Text revised (Regional, Chapter 4, Transportation Networks).

15. Text revised (Regional, Chapter 4, Transportation Networks).

16. See response number 13.

17. Text revised (Regional, Chapter 5, Transportation Networks).

18. Text revised (Regional, Chapter 5, Transportation Networks).

19. A brief definition and reference to BLM Manual, which has a detailed description of classes, are included in the Regional, Chapter 2.

20. Text revised (Regional, Chapter 8, Low-Level Scenario, Transportation Networks).

21. Text revised (Regional, Chapter 8, High-Level Scenario, Transportation Networks).

22. Table revised (Regional, Chapter 8, Table R8-10).

23. Text revised (all Transportation Networks sections).

24. Text revised (Regional, Chapter 9, Consultation and Coordination in the Preparation of the Draft Environmental Statement).

25. Text revised (Regional, Chapter 9, Coordination in the Review of the Draft Environmental Statement).

26. Railroad coverage is addressed in Chapter 8 as an alternative form of coal transport. Railroad transport is not proposed as the original intended form of coal marketing in the mining and reclamation plan analyzed in this statement. Map NB1-2 revised.

27. Railroad coverage is addressed in North Block, Chapter 8, Alternatives.

28. Oregon Shortline reference left in parentheses to show that it is a subdivision of Union Pacific Railroad Company (North Block, Chapter 2, Transportation Networks). Text revised (North Block, Chapter 2, Transportation Networks) in regard to rest of comment.

29. Text revised (North Block, Chapter 2F).

30. Text revised (North Block, Chapter 2F).

31. Text revised (North Block, Chapter 4, Rights-of-Way).

32. Text revised (North Block, Chapter 6).

33. Text revised (Twin Creek, Chapter 1, Support Facilities).

34. Text revised (Twin Creek, Chapter 1, Support Facilities).

35. Text revised (Twin Creek, Chapter 1, Authorizing Actions).

36. The reference to Oregon Shortline was not deleted here, because the Oregon Shortline is the applicant for the right-of-way. It was changed to show that the Union Pacific Railroad is the company with the Oregon Shortline a subsidiary. Text revised (Twin Creek, Chapter 2, Transportation Networks). It was felt that the coal mine and the power plant did not need to be shown on the map, since they would not be affected by the proposed mining.

37. Text revised (Twin Creek, Chapter 2F).

38. Text revised (Twin Creek, Chapter 2F).

39. Text revised (Twin Creek, Chapter 3, Soils).

40. Text revised (Twin Creek, Chapter 3, Transportation Networks).

41. Text revised (Twin Creek, Chapter 4, Rights-of-Way).

42. Text revised (Twin Creek, Chapter 6).

43. Text revised (South Haystack, Chapter 1, History and Background).

44. Text revised (South Haystack, Chapter 2, Transportation Networks).

45. Text revised (South Haystack, Chapter 2F).

46. Text revised (South Haystack, Chapter 2F).

47. Text revised (South Haystack, Chapter 3, Transportation Networks).

48. Text revised (South Haystack, Chapter 4, Rights-of-Way).

49. Text revised (South Haystack, Chapter 5, Transportation Networks).

50. Text revised (South Haystack, Chapter 6).

51. Text revised (South Haystack, Chapter 8, Operational Alternatives).

52. Text revised (Long Canyon, Chapter 1, Predisturbance Inventories and Analyses).

53. Text revised (Long Canyon, Chapter 1, Support Development).

54. Text revised (Long Canyon, Chapter 1, Interrelationships).

55. Text revised (Long Canyon, Chapter 1, Authorizing Actions).

56. Text revised (Long Canyon, Chapter 2, Transportation Networks).

57. Text revised (Long Canyon, Chapter 2F).

58. Text revised (Long Canyon, Chapter 3, Transportation Networks).

59. Text revised (Long Canyon, Chapter 3, Socioeconomic Conditions).

60. Text revised (Long Canyon, Chapter 4, Rights-of-Way).

61. Text revised (Long Canyon, Chapter 5, Transportation Networks).

62. Text revised (Long Canyon, Chapter 6).

63. The entire Air Quality sections of Black Butte have been revised to reflect more recent data.

64. Text revised (Black Butte, Chapter 2, Transportation Networks).

65. Text revised (Black Butte, Chapter 2F).

66. Text revised (Black Butte, Chapter 2F).

67. Text revised (Black Butte, Chapter 3, Transportation Networks).

68. Text revised (Black Butte, Chapter 6).

39

UTAH POWER & LIGHT COMPANY

P. O. BOX 899
SALT LAKE CITY, UTAH 84110

May 30, 1978

LEGAL OFFICES
SIDNEY G. BAUCOM
SENIOR VICE PRESIDENT
AND
GENERAL COUNSEL

ROBERT GORDON
350-3214

THOMAS W. FORSGREN
350-3213

VERL R. TOPHAM
350-3650

SAM F. CHAMBERLAIN
350-3825

ROSEMARY RICHARDSON
350-3796

MARY STIRK
LEGAL ASSISTANT
350-3217

Team Leader
Coal ES Team
Bureau of Land Management
P. O. Box 1869
205 Broadway
Lea Building
Rock Springs, Wyoming 82901

Re: Comments of Utah Power & Light Company re Southwest Wyoming Regional Environmental Impact Statement

Gentlemen:

1 Utah Power & Light Company is a potential developer and user of coal in the region covered by the Southwest Wyoming Regional Impact Statement and, as such, has an interest in seeing the preparation of the statement concluded at an early date. The following comments are of a general nature dealing with what we believe to be inherent problems and inevitable deficiencies in any regional impact statement and should not be construed as urging additional study or data gathering. We do not believe that any amount of study or data gathering can produce a meaningful environmental impact statement when prepared on a regional basis.

Regional impact statements of the type here under review are not required by the terms of the National Environmental Policy Act of 1969. That was clearly established by the United States Supreme Court in its unanimous decision in Kleppe v. Sierra Club et al., 59 L.Ed 2d, 576.

The Secretary nevertheless chose to proceed with preparation of several such statements. The draft statement now published and circulated for Southwestern Wyoming is among the first to reach that

39

stage.

The only chance for the experiment to terminate in success is if the Secretary will assess this statement with realism and admit that it and any other statements prepared on a similar scale should be dismissed and abandoned as useless and perhaps even detrimental in the protection of regional environmental values.

The Secretary should heed the decision in Kleppe v. Sierra Club, et al. and determine that the Department has no plan for the development of this region, nor does he have or can he have a plan for the development of any other region unless and until the Secretary is empowered to assume total control over all private property within the region and until the Government becomes the sole builder or developer of industrial facilities in the nation. The only basis for regional environmental statements must be rumor, hearsay and conjecture as to what facilities are planned within a region. To project environmental impacts from such suppositions can only result in a series of projections which will never approach reality. It will result in the resiting of some facilities based upon these false assumptions. When viewed in the light of reality, such relocations may as likely be harmful as helpful to the environment.

The best assessment of environmental impacts results from the traditional way of preparing a statement for a facility as the time permits or approvals are requested adn based upon facts which are known to exist at that time, not including speculations and rumors.

This process established by the Congress when it passed the National Environmental Policy Act in 1969 is adequate to assess impacts and afford protection to the environment.

The state of Wyoming has also imposed detailed and elaborate studies of its own in connection with the development of any major industrial facility in that state. To impose additional tiers of studies which waste time and resources and do not contribute in any meaningful way to the elimination or mitigation of environmental impacts is not prudent and is not in the interests of the government or its citizens.

The Secretary should determine that the Southwestern Wyoming Regional Impact Statement conclusively shows that such statements

have minimal value which does not justify the completion of those statements now being prepared or the commencement of any additional ones.

Very truly yours,

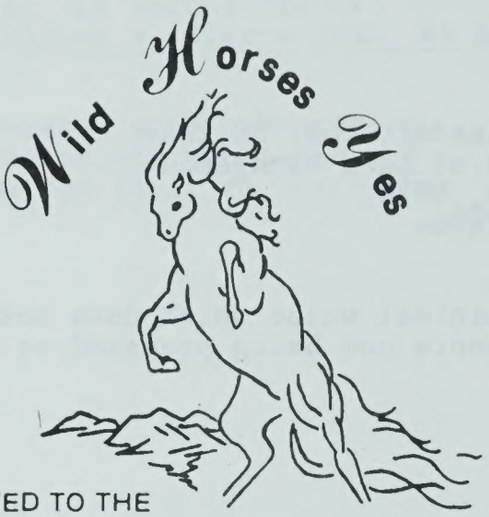
VERL R. TOPHAM

VRT:cw

Letter 39 Response

1. Although no federal proposal for regional development, as contemplated by Kleppe vs. Sierra Club, is presently before the Department, a number of site-specific actions with cumulatively significant regional impacts are being considered. The purpose of this regional coal ES is to assess these cumulative regional impacts in a single document.

40



DEDICATED TO THE
PRESERVATION AND WISE MANAGEMENT OF
OUR WILD HORSES

2245 E. Teton
Green River, Wyoming
May 31, 1978

Mr. Neil Morck
Bureau of Land Management
Rock Springs, Wyoming

Dear Mr. Morck:

At the last meeting of W H Y (Wild Horses Yes) discussion was held pertaining to the BLM draft environmental statement pertaining to the proposed development of coal resources, in Southwestern Wyoming. A resolution was also adopted directing that a statement be made representing the views and concerns of the membership of W H Y. Would you please make this statement a part of the hearing record.

1 As you know, our organization was formed by interested and concerned people that were not in agreement with present management plans as they pertained to the wild horses. This situation has not changed, in fact with the impact on range and habitate that could result with a series of strip mines further degregation of the range could result.

2 Most all of the area that involves coal development also has wild horses in the area. Any loss of habitate is of great concern to us. We realize that the developers talk about land reclamation but we know of no water rights requests made by anyone to do this reclamation.

Southwestern Wyoming has experienced a great influx of people the past twenty years and we are certain that further coal development will be extremely too over loaded facilities within the area and especially dewage disposal. It will also result in further use of the public lands for recreational use including people with 4-wheel drive vehicles that think they should be allowed to travel over each square foot of land. People polution is not the only concern we have, we have already been made aware by the state of the air pollution that is considered extreme.

At the present time wild horses are being removed from public lands so that they do not exceed the carrying capacity of the lands. These reductions will result in approximately an 80% in some areas. Some lesser reductions have been made in sheep and cattle numbers. I don't know if anyone can determine how much more a fragile environment can take that exists on BLM lands here in Southwestern Wyoming.

40

We appreciate the opportunity to be able to give our imput to this environmental statement.

Yours truly,

Kathy Monroe

Kathy Monroe, President
W H Y (Wild Horses Yes)

cc: Dan Baker

Letter 40 Responses

1. No significant impacts to wild horses were anticipated from the proposed mines because of the adaptability of these animals.

2. Because of the mobility of wild horses and the plan of the BLM to remove large numbers of horses from the Salt Wells/Pilot Butte Management Framework Plan area, no impacts to the horses are anticipated.

Thank you for this opportunity to comment on the draft environmental statement for development of coal resources in southwestern Wyoming. It is my understanding that this hearing is intended to determine how adequately the draft statement has assessed environmental impacts resulting from coal development, and these comments are so offered.

A main objection to this statement is the rather brief appearance of something called the "fish and wildlife mitigation" alternative which appears in the latter portion of Volume I. It can be argued, on both economic and esthetic grounds, that such an alternative ought not to be an alternative at all. Rather, it should be a principal policy element attending any mineral development which disrupts or destroys habitat. It appears that the Bureau of Land Management intends that the future of wildlife in coal mining regions be dependent on two fortuitous events: (1) that native plant species will be able to recolonize mined lands in a reasonable span of time, and (2) that native wildlife will be able to maintain viable breeding populations during mining and post-mining periods. This is assumed to occur given the synergistic effects of direct and indirect habitat loss, increased stress, noise, air and water pollution, and disruption of developed information channels (such as trails, migration routes, breeding grounds, etc.) The Bureau of Land Management should be mindful of

a wildlife conservation principle set forth by Aldo Leopold in 1933, and I quote: "Both scientists and sportsmen now see that effective conservation requires, in addition to public sentiment and laws, a deliberate and purposeful manipulation of the environment ... There are still those who shy at this prospect of a man-made game crop as at something artificial and repugnant. This attitude shows good taste but poor [redacted] insight. Every head of wildlife still alive in this country is already artificialized, in that its existence is conditioned by economic forces. Game management merely proposes that their impact shall not remain wholly fortuitous. The hope of the future lies not in curbing the influence of human occupancy - it is already too late for that - but in creating a better understanding of the extent of that influence and a new ethic for its governance."

There seems to be an attitude afoot that wildlife is of little economic importance in southwestern Wyoming. This is a bit odd, in light of the fact that fish and wildlife are one of only a handful of long-term, renewable economic resources found here. Disruption of fish and wildlife habitat and populations thus represent a direct economic loss to this region. Recovery of this loss is entirely dependent on the ultimate success of mined land reclamation or steps

taken to improve carrying capacities of lands adjacent to mined areas. The Wyoming Game and Fish Department recently completed an analysis of the present and potential economic values of wildlife resources in southwestern Wyoming. Direct expenditures [redacted] by hunters and fishermen in 1978 are estimated to be $24,540,000 Total economic values of fish and wildlife, including non-consumptive uses and values to tourism and resident travel patterns, are approximately $91,756,000, based on 1975 Wyoming Game & Fish estimates and an annual inflation rate of 7%. Capitalization of this resource at an interest rate of 6 3/4 % yields an actual or replacement value of $1,359,340,000 in 1978 for wildlife resources in the southwestern region.

I offer these figures to indicate the true value of a resource which can be perpetuated far into the future by utilizing the excellent forms of habitat management that are now are available. By comparison, mineral resources can be expected to have a much shorter lifespan. Any efforts directed at maintaining wildlife populations, in the face of coal development, will pay handsome dividends in the future.

Letter 41 Response

1. Because the boundary of the southwestern Wyoming ES region does not coincide with the boundaries of the Wyoming Game and Fish Department's data analysis units from which economic values are derived, these values cannot be related to the ES region.

42

(307)
635-3416

WYOMING OUTDOOR COUNCIL
P.O. Box 1184 2003 Central Cheyenne, WY 82001

Team Leader
Coal E.S. Team
BLM Rock Springs Office
Rock Springs, WY 82901

Dear Sirs:

On behalf of the Wyoming Outdoor Council (WOC), I offer the following comments on the Southwest Wyoming Coal draft E.S. Since our concerns revolve around the North Block, Long Canyon, and South Haystack mines, I'll comment on each of those proposals individually.

North Block

1) The entire proposal as discussed in the dES is predicated on the assumption that North Block coal will fire Naughton units 4 & 5. Yet the Utah Power & Light 1977 Annual Report states:

> Two additional 400 megawatt units are planned for the Emery (Utah) site. We had previously planned to build them at the Naughton Plant near Kemmerer.

1

The Report states further that "increasing costs of construction and fuel at the Naughton location" and "excessive delays in obtaining governmental approvals" precipitated the switch to Emery. Naughton 4 & 5 are not at all certain in Kemmerer; in fact, they are unlikely.

While we realize that a switch in marketing strategies for coal may cause little or no change in the impacts of a proposed mine, we challenge the timing of bringing the North Block into production, and of releasing the now outdated dES.

2

Given the unliklihood of Naughton 4 & 5, does the North Block mine still appear necessary, in light of its extreme environmental costs?

2) The mine's environmental costs to the Hamsfork River far outweigh the benefits of this marginal mine. South Lincoln County's only river, the Hamsfork sustains municipal, agricultural, industrial, and recreational waters. It is an excellent fishery enjoyed by thousands of Wyomingites and Utahans as well. Would BLM condone the spoiling of some 50 miles of its waters, as discussed in the plan? 42

3

3) A mine life of 35 years is startling in light of the company's plans to spoil on the Hamsfork floodplain. How long will the north end spoil ooze silt and other pollutants into the river? What will be the effects of such a scheme over the next 50-100 years?

4

4) Studies on average annual flows of the Hamsfork show a present reduction of about 62% in its natural flow, caused by irrigation and process water for the power plant. While much of the irrigation water returns to the river, the Naughton plant consumes about 10,000 acre-feet of Hamsfork water annually. If the plant is expanded by two units, Viva Naughton Reservoir must also be expanded to service the new units. A rise of 10 feet in Viva Naughton will double its capacity and raise its evaporative losses by about 7,000 acre-feet annually. The new units would require an additional 13,400 acre-feet per year, all of which will be consumed.

5

Using the above scenario as a base, studies project the eventual demand on Hamsfork waters to reach 89% if the plant expands. That reduction in flow, coupled with the already rising siltation and salinity loads in the river will significantly degrade the river. Increased siltation caused by the North Block mine might degrade the Hamsfork beyond immediate repair, causing changes in the stream's natural course and elimination of the already threatened breeding habitat for fish.

Given the above considerations, is an estimate of 50% loss of the Hamsfork fishery understated? Might not that loss be total?

6

5) The direct loss of $1,311,827 worth of fish and wildlife resources is totally unacceptable. (Does the above figure include "capitalization?" Inflation over 35 years? The "multiplier rate" associated with use of the resource by non-residents?) Who is willing to grant Kemmerer Coal Company the right to disrupt other segments of the local economy which are based on the natural values of the Hamsfork?

6) The loss of any habitat critical to the Shiras moose is unacceptable to the Wyoming Outdoor Council. Hamsfork valley is some of the finest moose habitat in North America.

7

7) Some specific comments on pages from the dES:

pg. NB3-20--The rating system employed throughout the ES to assess "visual resources" is about as inane as it can be. This writer views the Hamsfork valley as one of the most beautiful in the state, from all "viewpoints and views." The paltry attempt to quantify the "values" of the river's "visual resources" is sheer hocus-pocus. "Visual Management Resource Classes" sounds like the worst classes one takes in college.

pg. NB2-30, NB3-25, NB3-28--Some interesting and accurate observations on these pages, ie., that "many older residents resent the recent industrial growth in the Kemmerer area." Such has been WOC's experience in Kemmerer, too. Also, an accurate insight into the attitudes of the poor and those on fixed incomes.

pg. NB8-1, the "No Action" alternative--Papagraph four (4) states, "increased use would basically lower the "primative" (spelling?) quality of the recreational experience which is common to the area around the North Block." (A similar phrase appears under "No Action" sections in each proposal in the dES.) The strange logic used to develop the above paragraph would suggest that No Action--ie., no North Block mine--would lead to rapid degradation of the "primative" Hamsfork qualities, due to increased use of a largely undegraded stream.

8 Is the author of this astonishing paragraph suggesting that by strip mining near the Hamsfork, dumping tons of silt into its waters, and spoiling its abilities to support fish and wildlife, we will actually protect the river better than if we had left it alone? Will the North Block mine protect the "primative" qualities of the river?

The moral of the scenario seems to be that a well placed strip mine on a stream's floodplain will keep those damned destructive fishermen away from the water. Good thinking.

9 pg. NB8-1--"Environmental Recommendations" #2: How can 2,600 acres of land be managed for fish populations? How fast can we expect these fish to evolve? Even if one takes the referenced paragraph less literally, how will those 2,600 acres be managed to promote fish and wildlife populations? Given that the Hamsfork floodplain there will be degraded by 35 years of silt runoff, what mitigation measures will be successful? Who will pay for them?

10 8) Some of the Alternatives for Mitigation are absolutely necessary if mining is to proceed along the North Block. Mitigating Measure #7 (sediment ponds) would be necessary to minimize degradation of the river. Also, the "Hamsfork Protection Alternative" outlined on NB8-4 sounds like a must. The extention of the mine's northern boundary across the river is most alarming. Common sense and good faith on the part of the company should have led its planners to abandon all parts of the mining and spoils area which would impinge on the river's floodplain. Obviously, Kemmerer Coal cares little for the unique Hamsfork River.

9) WOC recommends the No Action alternative. Mitigating measures notwithstanding, a new mine encompassing part of the Hamsfork drainage is an unacceptable use of public lands which are critical to the maintenance of fish and wildlife habitat as rich as the Hamsfork's. BLM, as an agency charged with the stewardship of public lands, should exercise common sense and reason in its review of the environmental costs weighed against the "benefits" of the North Block mine. Common sense and reason dictate against the operation of the North Block mine.

Long Canyon

11 1) The extent of damage to the area's abundant archaeological resources must be more thoroughly studied before the Long Canyon mine proceeds. A total of 68 known sites and another 79 sites possible constitutes a significant archaeological discovery in Wyoming. Disturbance or destruction of these unexcavated sites is unacceptable.

In addition, the possible destruction of the Cedar Canyon petroglyphs, presently "in a reasonably good state of preservation," must be carefully studied. Petroglyphs and other forms of rock-art, rare in Wyoming, should be preserved for future generations. Because of the delicate nature of surface rock-art, even relatively small subsidences might deface the irreplaceable petroglyphs. The man-induced spoilage of this unique archaeological resource is unacceptable. Until the company has proven beyond any doubt that the Cedar Canyon 'glyphs will not be disturbed by mining operations, mining in the area should be prohibited.

12 2) The elimination of 432 acres of "crucial winter range for elk" is unacceptable. The disturbance of an additional 2,200 acres of elk and deer range is also unacceptable. The economic loss of $704,320 as a result of deer and elk losses presents an abominable scenario. Those dollars are shared by a large segment of the local and state economies. The company should not be permitted to damage other traditional parts of the economy.

South Haystack

13 1) WOC's concerns with this proposal center on the destruction of "two major strutting grounds" of the sage grouse. How will the disturbance of these two leks affect sage grouse populations in the rest of Lincoln County? In conversations with southwest Wyoming Game and Fish people, WOC staff has learned that strutting grounds are rare in south Lincoln County. The two strutting grounds in question might be critical to the maintenance of sage grouse populations in the County. Will that question be addressed in the final EIS?

14 2) On pg. SH3-14, economic losses to deer and antelope are assessed. Why no assessment of economic losses to sage grouse?

15 3) Why is there no mitigating measure suggested for loss of sage grouse habitat? The "environmental Recommendation" #2 on pg. SH8-1 is hardly adequate to the task of mitigating the devastation of sage
16 grouse leks. How will that 3,300 acres be managed to aid in the maintenance of sage grouse populations?

4) Unless some alternatives are devised which will divert the destruction of the sage grouse habitat, WOC recommends the No Action alternative for the South Haystack mine.

Thank you for the opportunity to comment on the dES for Southwest Wyoming Coal.

Sincerely,

Don Snow

Don Snow, staff.

Letter 42 Responses

1. It is recognized that coal from the North Block Mine may or may not be used in Naughton Unit 4. The mining and reclamation plan on file with the USGS indicates that the coal would be used to help supply the additional unit at the Naughton Power Plant. Because of the uncertainty of the identified market, the Different Utilization--Off-Site Markets Alternative was developed, see North Block, Chapter 8.

2. This is a factor that the decision maker may consider; however, the purpose of the ES is to analyze the environmental impacts of the proposed mining and reclamation plans.

3. This subject is covered in the site specifics, Chapter 4, and the Regional, Chapter 3. Also, see North Block, Chapter 8, Hams Fork Protection Alternative.

4. Text revised (North Block, Chapter 8, Hams Fork Protection Alternative). Executive order 11988 directs agencies to identify impacts to floodplains of any proposed action and to consider alternatives to avoid adverse effects and incompatible developments within floodplains.

5. An additional 400 megawatts would require about 7,200 acre-feet per year. Local experience shows a water use ranging from 17 to 18 acre-feet per year per megawatt installed capacity. It is possible, but unlikely, that as much depletion as suggested would be allowed on Hams Fork. A spoil pile on the floodplain of Hams Fork would generate sediment (see North Block, Chapter 3, Water Resources and Fish and Wildlife sections). Text revised (North Block, Chapter 3, Fish and Wildlife, discussion of fishery).

6. The North Block mining and reclamation plan is being returned to the Kemmerer Coal Company for modification to include the provisions of SMCRA. Such modification would substantially reduce the wildlife impacts on the Hams Fork.

7. BLM's Visual Resource Management Class II designation of the Hams Fork valley is the highest class which can be given under that system without formal designation as a "wilderness or natural" area. After reevaluation of statement, no text change was made.

8. There would be an increase in recreational use even without the proposed coal mining. Comparison of the numbers "with" coal mining to the "No Action" shows that the "with" numbers are higher than the "No Action." Either way, it is felt that any increased use would degrade the primitive quality which currently exists.

9. Text revised (North Block, Chapter 3, Fishery, and Chapter 8, Fish and Wildlife Mitigation Alternative).

10. These environmental impacts are presented for the decision maker's consideration.

11. Mitigation of these impacts is covered in Long Canyon, Chapter 4.

12. This subject is covered in Long Canyon, Chapter 8, Fish and Wildlife Mitigation Alternative and Surface Facilities Relocation Alternative.

13. Text revised (South Haystack, Fish and Wildlife sections).

14. Text revised (South Haystack, Chapter 3, Fish and Wildlife).

15. The Fish and Wildlife Mitigation Alternative includes all wildlife that could be impacted.

16. The methods of management of this fish and wildlife mitigation area will not be developed prior to intensive surveys and inventories designed to determine the best methods of management.

43

P. O. Box 14
Cora, Wyoming 82925
May 29, 1978

Neil Morck, District Manager
Bureau of Land Management
North of Rock Springs
Rock Springs, Wyoming 82901

Dear Mr. Morck:

The Wyoming Wildlife Federation is concerned and opposed to the proposed coal development in the Rock Springs BLM management district.

1 The Federation feels many of the present multiple uses such as wildlife, livestock, wild horses and many rare and endangered species will be eliminated or drastically reduced if the proposed coal development comes to pass.

The habitat for livestock and wildlife is insufficient in many of the areas with the wild horse population explosion, the present coal, trona and many other resource developments.

People impact has been a key factor in the loss of valuable habitat through the abusive overuse of the four-wheel drive vehicle, motor cycle, and other types of multi-terraine equipment.

We are concerned with the never ending seismic exploration for gas, oil, and minerals with little or no consideration given to the shallow top soil and the lack of precipitation to heal and rehabilitate the badly needed grass and forbs for wildlife, game birds, wild horses and domestic livestock.

Must Wyoming give up all of its renewable resources just to develope its non renewable resources? The Wyoming Wildlife Federation thinks not, if the following constraints are practiced;

1. Orderly development
2. Rehabilitation at the same pace as development
3. New and less devastating methods for exploration of minerals, oil and gas
4. More restrictive regulations for vehicle use on public land.
5. Erosion control
6. Water development

Sincerely,

James Noble, Director
Wyoming Wildlife Federation

cc: Dan Baker

Letter 43 Response

1. The purpose of this environmental statement is to define and analyze the adverse impacts which could be expected should the proposed actions be authorized and to provide to the decision maker mitigation or alternatives for his consideration.

44

May 25, 1973.

To: Team Leader
Coal ES Team

From: Margaret M. Haggard
Pine Bluffs

Subject: Draft Environmental Statement
Southwestern Coal Region of Wyoming

After reading the environmental statement on the development of coal reserves in southwestern Wyoming, I am aware more than ever before of the incredible price we will have to pay for this endeavor.

Our way of life will be gone - possibly forever. It has already disappeared in Rock Springs and Gillette. Life in these towns now has many ugly aspects the effects of which will be lasting.

1 The projected loss of wildlife is staggering. Even if wildlife habitat can be re-established, it is likely that only game animals will be re-introduced into the area. The loss forever of non-game wildlife will surely result in a further disturbance in the balance of nature.

It is almost certain that the wild horses in the areas of the proposed mining will, in time, disappear. There will be reasons, contrived and otherwise, found to justify their removal from the range.

OLL leasing power poses a threat. It has the potential to destroy vast stretches of range. It usually yields to the prevailing pressure - a persistent failing of the federal government.

2 There are studies that estimate it may take 50 years to completely restore strip mined range - if it is really possible at all. And, critical to the restoration of the mined area is the annual rainfall which must be greater than 10 inches.

But, the coal will be mined and the price will be paid - not only today but, for many tomorrows to come.

Margaret M. Haggard
Margaret M. Haggard.

Letter 44 Responses

1. It is likely that nongame wildlife would be the first animals to reestablish themselves in newly reclaimed areas, since the complex community needed to sustain most game animals would take many years to develop.

2. The time period and precipitation limitation mentioned are apparently derived from the National Academy of Science publication Rehabilitation Potential of Western Coal Lands 1974. The authors of this publication provided findings and recommendations concerning the rehabilitation of western coal lands.

Their definition of restoration implies that ". . . the conditions of the site at the time of disturbance would be replicated after the action." Their definition of reclamation, which would be the goal for the lands proposed for mining, implies that ". . . the site is habitable to organisms that were originally present or to others that approximate the original inhabitants." In regard to restoration, the report stated ". . . in the western coal areas complete restoration is rarely, if ever, possible."

In regard to precipitation limitations, the committee stated that drier areas ". . . receiving less than ten inches of annual rainfall, or with high evapotranspiration rates, pose a more difficult problem. Revegetation of these areas can probably be accomplished only with major, sustained inputs of water, fertilizer, and management."

In Vories (ed. 1976), Dr. C. Wayne Cook stated, in regard to mining areas with only 7 to 10 inches of precipitation, that "If we give it enough effort, we can initiate natural plant succession to some degree . . . Here, I think we can start these native species such as shadscale, dondia, fourwing saltbush, and . . . greasewood . . ., maybe squirreltail grass, Indian ricegrass, needle-and-thread grass, curly grass and galleta grass with the use of water and fertilizer. Then, after 30 to 50 years, the area should be back to a relatively normal state."

45

Russell Hynes
1344 Uinta Drive
Kemmerer, Wyoming 83101
May 17, 1978

Mr. Fran Eickbush
Team Leader
Southwestern Wyoming Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

Dear Mr. Eickbush:

I would like to compliment the ES Team for the effort that has been made in compiling the Draft Environmental Impact Statement for proposed development of coal resources in Southwestern Wyoming.

1 However, I believe the estimates that have been made as to the losses of wildlife as a direct result of mining operations are overstated. I would like to share some personal observations made during my two years in the mining industry in Southwestern Wyoming.

Commencing in March of 1976, through the fall of 1977, I observed very few mule deer. However, commencing in the winter of 1977 and 1978, and into the spring of 1978, I have observed, almost daily, numerous mule deer within the Mine area and, many times, within 100 yards of the Mine operation. A substantial number of these deer are still at the Mine site.

During the summer of 1977, on several occasions, I observed antelope grazing on a reclaimed portion of the spoil pile within a few yards of operating Mine equipment. During the fall of 1976, I observed a golden eagle proceeding to catch a sage grouse for dinner within a few yards of the disturbed Mine area. In the winter months of 1978, I observed a bald eagle feasting on a rabbit within a few hundred yards of operating Mine equipment.

For three consecutive springs I have observed a sage grouse strutting ground adjacent to the Mine property. Judging from the relative numbers of strutting grouse, it is apparent that the grouse population in the area is increasing. In the spring of 1977, the employees with whom I work were taking extreme caution not to disturb a nesting sage grouse until she had hatched her chicks. However, Mother Nature made their efforts in vain, when one of the hungry fox that resides within the Mine area, had the eggs for dinner. During the summer of 1977, there were two established red fox dens within the Mine area, one of which was between the tipple and the spoil pile.

45

It has been my observation that the wildlife readily adapts to the changing conditions in the environment resulting from Mine operations.

Sincerely,

Russell E. Hynes

REH/ph

Letter 45 Response

1. In the section which discusses population losses, a more detailed explanation is given concerning the rational behind the seemingly large numbers (see final ES, Regional, Chapter 4, and site specifics, Chapter 3, Fish and Wildlife).

46

Box 586
Kemmerer, WY 83101
May 30, 1978

Team Leader
Southwestern Wyoming Coal ES Team
P.O. Box 1869
Rock Springs, WY 82901

Dear Mr. Eickbush:

The following comments are mainly directed at the perceived effects of mining along the Hamsfork River. There appears to be some uncertainty in the statement as to how the North Block Mine might affect the watershed. This uncertainty would seem to indicate that the statement is inadequate in respect to its analysis of various watershed effects. Hopefully, the following material may be of some use in further pinning down the effects of the proposed federal action on the Hamsfork watershed.

The Hamsfork is at a critical point in its history - it is experiencing increasingly depleted flows at the same time that its sediment load is increasing. Either situation alone is serious enough, and combined they can only indicate severe problems ahead. The proposed federal action will likely add to the severity of the problem. In November, 1977, the Wyoming Outdoor Council sponsored a river management workshop for the Hamsfork. That workshop yielded some interesting information concerning, among other things, flow depletions and water quality problems. The data presented below are largely derived from USGS information and the Bureau of Reclamation's Sublette Project Report.

Hamsfork Watershed

(1) Current Active Reservoir Capacity-

Viva Naughton-	42,390 acre-feet
Kemmerer #1-	1,060 acre-feet

(2) Future Added Reservoir Capacity-

Viva Naughton-	Expansion to 90,000 acre-feet

(3) Average Annual Inflow at Viva Naughton- 80,000 acre-feet

(4) Current Flow Depletions-

Irrigation-	30,000 acre-feet
Industrial-	13,000 acre-feet
Evaporation-	2,500 acre-feet
Culinary-	4,000 acre-feet
Total-	49,500 acre-feet
Ave. Downstream Flow-	30,500 acre-feet
Ave. Flow Reduction-	62%

Note: Since irrigation withdrawals occur all along the river, the downstream flow figure is essentially that at Granger, Wyoming, at the confluence of the Hamsfork with the Blacks Fork River.

(5) Additional Future Flow Depletions-

UP&L Units 4 & 5-	13,400 acre-feet
Additional evaporation from enlarged Viva Naughton-	4,500 acre-feet
Additional municipal requirements-	2,100 acre-feet
Supplemental irrigation-	2,000 acre-feet
Total-	22,000 acre-feet

(6) Total Future Depletions- 71,500 acre-feet
Ave. Flow Reduction- 89%

Again using Granger as a benchmark, one could expect an average 70% reduction of the current flows during the next 20 years (neglecting releases from storage).

It is important that the proposed federal action be considered within the context of overall changes in watershed function. It is linked to developments which will deplete Hamsfork flows by about 20,000 acre-feet per year, or 25% of its average annual flow. These developments will cause an increase in sediment loads (both from mining and settlement impacts), higher concentrations of pollutants from point and non-point sources due to lower river flows, and some impairment of the river's hydrologic functions. The effect on fisheries
2 is potentially very severe, given the location of the North Block Mine and the points of its sediment discharges to the river. The environmental statement assumes that North Block mitigating measures will be 80% effective in preventing sediment discharges to the river, based on the North Block Mine and Reclamation Plan. Yet this same plan has been repeatedly returned to the Kemmerer Coal Company by the Wyoming Department of Environmental Quality due to its deficiencies (see correspondence file, Wyoming DEQ, North Block Mine and Reclamation Plan).
3 If sediment quantities from the North Block Mine are large enough, coupled with greatly reduced flows, it is conceivable that the river may even begin to adjust its channel geometry, with all the undesirable effects which accompany such adjustments.

I strongly urge the ES team to take another look at the effects of the North Block Mine in releasing sediments to a river whose flows will likely be greatly depleted during the next 20 years. Its values as riparian habitat, wet meadow hayland, a culinary water source and as a fishery are exceptional.
4 The importance of the Hamsfork to those who use it cannot be overstated. One need only study a typical LANDSAT image (such as NASA ERTS E-1374-17360-4 02) to gain an appreciation of the current productivity and health of the Hamsfork watershed compared to other streams in this region. The Sublette Project Report classified the Shiras Moose as a species of international importance due to its limited range and value as a game animal. Many professional game managers have
5 indicated that the Hamsfork may well be the finest Shiras Moose habitat in existence. Surely the Hamsfork deserves more careful consideration and more thorough analysis of the effects of mining along its channel.

With warmest regards,

Ken Morgan

Ken Morgan

Letter 46 Responses

1. Text revised (North Block, Chapters 2, 3, and 4, Water Resources, Surface Water).

2. See discussion of fisheries in North Block, Chapter 3, Fish and Wildlife, and response number 1.

3. See response number 1.

4. See response number 1.

5. See response number 1 and revised North Block, Chapter 8, Hams Fork Protection Alternative.

29 May 1978; 27°C 47

Bureau of Land Management
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82001
Attention: Team Leader, Coal ES Team, P.O. Box 1869, Rock Springs, WY 82901

Dear Sir or Madam:

Thank you for sending me copies of the Draft Environmental Statement for the Development of Coal Resources in Southwestern Wyoming, as per my request. I find the documents to be well-done and comprehensive and the data collection exhaustive. However, I also find several deficiencies which I wish to call to your attention. My comments are directed to the volume titled Regional Analysis only.

1 Having done research in the region on energy resources and the impacts of their development, I am at a loss to explain the lack of attention the draft Statement pays to the potential development of oil shale in the immediate vicinity of the proposed coal development. Not only do the two resources compete for regional water, land, work force, transport, and attention, the cumulative impact of BOTH the proposed coal development and oil shale development in Wyoming could overwhelm the regional resource base and degrade the environment of a state and adjoining states. The water for such development simply is not available. Oil shale development is not a remote possibility and with recent advances in in-situ recovery of shale oil, the hitherto less attractive Wyoming oil shale leases could be developed quite soon. The Final Statement should address this possibility. Data is readily available in the Bureau of Land Management's Final Environmental Statement for Oil Shale Development, published in September, 1973.

2 The draft Statement assigns a coal "region" based on political borders of states and areas of responsibility of the BLM. Your analysis stops at the state boundary. Unfortunately, the impacts will not, and the physical, economic, and socio-political impacts will spill over into Utah, Colorado, and Idaho. The Colorado River System ties the region together and this feature is the one cohesive factor in regional analysis that should be thoroughly explored and utilized in the Final Statement. Remember, California and New Mexico, far removed in distance from the sites of potential development of southwestern Wyoming coal, have an interest in how Colorado (and Green) River water is consumed.

3 Regarding your impact analysis on EPA Class I and II Air Quality areas, you suggest that the proposed action could reduce visibility at Fossil Butte National Monument as much as 45% (page R4-8). Fossil Butte may be redesignated Class I in the near future. What will happen to the proposed action if this occurs? You note the redesignation possibility, but do not follow-up on the effect.

4 The analysis of changes in local and regional topography (page R4-11) says that certain stream channels will be obliterated. If this occurs, sheet erosion will take place and overland flow of runoff will carve new channels, but your analysis fails to consider the effects of the new hydrology the proposed action

47

will create.

5 Finally, I seriously doubt that the development of coal in the study region will allow for the discovery of new fossils, create new vistas that will attract tourists, and give a long-term boost to regional economies. The construction of needed facilities for health care, schooling, and transportation entail financial obligations far into the future, and unless a proper infrastructure is established, this can be a great drain on local treasuries long after the "boom" wears thin.

The maps in the Appendix are good altho a bit too general. I appreciate the effort and cost involved in preparing this Statement. As a geographer, I am familiar with the constraints you are faced with in attempting such a study.

Thank you for the opportunity to comment and I request that my comments be made a part of the official record.

Sincerely,

David L. Schein

David L. Schein

5219 N. Reserve
Chicago, Illinois 60656

Letter 47 Responses

1. Future development of oil shale in the region is still an unknown. Economic factors controlling oil shale development are currently unfavorable. Oil shale resources are large and will require a separate future consideration.

2. Recent analytic modeling indicates that, while there will be spillover impacts, the major, significant impacts will occur within the ES region.

3. Text revised (Regional, Chapter 4, Air Quality, Emissions from the Coal Mines).

4. These subjects are discussed in the Regional, Chapter 4, Water Resources, Surface Water section.

5. Recent analytic modeling indicates that there will be long-term economies to the region.

Although it is not anticipated that new vistas would be created, it is anticipated that some tourists would be attracted to the area to view the mining.

A benificial impact of development would be the exposure of fossil materials for scientific examination and collection which otherwise may never occur, except as a result of overburden clearance, exposure of rock strata, and mineral extraction.

June 13, 1978

48

Mr. Neil Morck
District Manager
Bureau of Land Management
P. O. Box 1869
Rock Springs, Wyoming 82901

Dear Mr. Morck:

This letter is being written for consideration to the Final Draft on the Southwest Coal study.

The following comments are my feelings on certain issues that I feel are very pertinent to this study so am limiting my thoughts to these specific issues:

Wildlife and its habitat should be given every opportunity to carry on its way of life i.e. their migration routes to and from wintering grounds, to bring forth their young in their summer grounds and have the solitude free of the following:

1 2 Roads - limit roads to those only necessary to serve industry and private land owners. Private land owners and industry should be required to submit road plans across public lands. There should be closure of all off-road vehicle traffic across public lands e.g. the mess that the oil industry has created at LaBarge, Birch and Middle Piney Creeks, and is now in the process of doing east and north of the town of La Barge, Wyoming. An aerial flight over Southwest Wyoming seems to indicate an excessive amount of vehicle traffic(tracks-unestablished roads.) This wandering is done by mineral exploration or by off-road vehicles creating a surface vulgaration of public lands that has no equal.

Water - Retain and improve water quality whereve possible.

Over grazing on public lands by the livestock industry - The necessity of changing bedding grounds by the sheep interestes.

Mineral Glut - take a strong psoition to eliminate over production of minerals taken from public lands. Cheap minerals produce wastefullness.

48

I believe the Sikes Act directs the Federal and State Agencies to manage wildlife and its habitat in a cooperative effort.

Sincerely yours,

Floyd Schneider

Letter 48 Responses

1. Private landowners and industry are required to submit road plans across public lands.

2. Off-road vehicle use is a legal recreational use of public lands. The BLM is preparing new regulations for the control of off-road vehicle use on public lands.

49

Box 392
Green River, Wyo. 82935
June 15, 1978

Team Leader
Coal ES Team
P. O. Box 1869
Rock Springs, Wyoming 82901

Dear Sir;

The following are my comments on the Environmental Statement for the Southwestern Coal Region of Wyoming.

1 | Gradual population growth is inevitable but sudden growth causes many ill feelings between native and newcomer.

2 | I feel it would be better for the quality of life in Southwestern Wyoming if the number of proposed mines were decreased and the coal removal and employment spread out over a greater number of years.

3 There is no way the communities of Southwestern Wyoming can absorb the type of rapid growth which will accompany these proposed mines. Since the 1975 Parker & Assoc. report, most schools in Green River have become filled to capacity. Mental Health and social services are sub-standard. Any expanded facilities have not kept pace with population growth.

What benefits are there to living in a larger city? The population in Sweetwater County has more than doubled since 1971 and although there are more stores it can be impossible to find a simple item; it just takes longer to find out none of the stores has that item.

4 The increased population will mean more 4-wheel drive vehicles and motorcycles our 'hill climbing' and otherwise tearing up the fragile plant growth of Southwestern Wyoming. 'Hill climbing' destroys plant growth and disturbs soil making it susceptible to erosion; hence water and air pollution, loss of wildlife habitat and ugly scars.

In conclusion, I hope that the proposed mines are not approved or that only limited action will be allowed.

Sincerely,

Gay Shedden

Gay Shedden

Letter 49 Responses

1. This subject is discussed in the final ES, Regional and site specifics, Attitudes and Expectations sections.

2. Text revised (Regional, Chapter 8, new Defer Federal Approval Alternative).

3. Refer to text change provided by the State of Wyoming in the Regional, Chapter 3, concerning community impact analysis.

4. This was discussed in the text by giving estimated increase in visitor demand by off-road vehicle users, then discussed in the Vegetation, Fish and Wildlife, and Cultural Resources sections (see Regional, Chapter 4, and sites specifics, Chapter 3, Recreational Resources sections).

The following comment letters were received subsequent to the published response period. They were reviewed by the analysist on the ES team. Substantive comments were evaluated and, although formal responses are not included to all the comments, the text of the final ES has been revised in response to the comments wherever feasible and as time permitted.

50

[illegible]
JUN 28 [illegible]
CHEYENNE, WYOMING

WYOMING
EXECUTIVE DEPARTMENT
CHEYENNE

ED HERSCHLER
GOVERNOR

Routing 6/28/78 Initial & Date
1 SD
2 RB 6/28
OF
Lead Resp.

June 26, 1978

Mr. Daniel Baker
State Director
Bureau of Land Management
Department of the Interior
P.O. Box 1828
Cheyenne, Wyoming 82002

Dear Mr. Armstrong:

The State of Wyoming has completed its review of the Development of Coal Resources in Southwestern Wyoming Draft Environmental Statement and has found the draft statement to be unsatisfactory in several major areas. Due to the large amount of material provided within the two volumes, our comments will focus only on the socio-economic and environmental aspects of the draft statement. Detailed comments may be found within the attached state agencies responses.

Socio-Economic Problems

Specifically, we find the following problems which deserve further consideration and resolution prior to the completion of the final statement.

Population

The population projections used throughout the DES show significant discrepancies compared to the State ADAS II 1980 projections.

1

	BLM	ADAS II
Lincoln County	13,641	11,246
Uinta County	13,928	10,635
Sweetwater County	48,283	35,685

Assumptions about the "most probable level of development ..." (table R1-2) must be corrected.

Employment

2 Major discrepancies also develop between the DES employment projection and the State ADAS II employment projections. See Estimated Employment by Sector and County Table (attached). As a general point of clarification, it would be
3 helpful if the DES indicated projected coal production somewhere on Table R1-2 in order to relate coal employment with coal production.

Personal Income

In reviewing the DES personal income, inconsistencies with the DES personal income projections are evident.

PERSONAL INCOME 1980

4

County	BLM Per Capita	BLM Total*	ADAS II PER CAPITA	ADAS II Total*
Lincoln	$6,921	$73.0	$7,130	$79.8
Uinta	$6,761	$94.0	$5,740	$60.8
Sweetwater	$8,660	$446.9	$6,370	$227.8

*million omitted

5 Until the descrepancies regarding base assumption can be resolved, it is impossible to identify how much of the variation is real versus how much results from differing employment, population and personal income figures.

Infrastructure

6 This section of the DES is not useful for local government officials who are responsible for taking action to mitigate impact problems or to the state or federal government in providing assistance.

7 The figures used to describe the existing situation are generally out of date. Current information is readily available but is not reflected within the DES. Many city and county responsibilities which represent high percentages of local government expenditures were largely ignored. These inconsistencies and lack of thoroughness destroy the DES's credibility as a basis for state and local decision-making.

8 Also, the confusion resulting from the inconsistencies and incompleteness compound the problems of dealing with impacts on the local level. For example, the topic of education within the infrastructure section is very difficult to follow. Population is not projected in sufficient detail to determine classroom capacity requirements, so the classroom requirements projected in table R4-20 cannot be confirmed or even realistically evaluated. Furthermore, the DES provides classrooms only and does not consider either the conditions of existing facilities, whether extra classrooms could be added to current buildings, or the need for additional new school buildings.

9 Under the topics of law enforcement and fire protection, the data used within the DES is either out-of-date or not sufficient enough to complete the tables. Attached are proposed corrections for tables: R2-47, R2-49, and R2-50.

Environmental Empact Problems

Several of the state agency comments provide pertinent responses to the inadequacy of the DES's environmental impact sections. These responses will not be repeated herein, however the major shortcomings of the DES will be identified.

Air Quality

10 The DES fails to entertain the fact that the Clean Air Act Amendments of 1977 (approved in August of 1977) will have a major impact on necessary requirements. The best management practices to reduce fugitive dust are inadequately explained. Control of fugitive dust should be further evaluated and specific air quality specifications must be reflected within the DES.

Water Quality

11 In reviewing the sections relevant to water use and water quality, several inaccuracies are evident. Further analysis of the "use of unappropriated surface water"...must be
12 accurately expressed. The future impacts of possible diversion and/or impoundment are not sufficiently considered. The DES
13 consistently fails to include the necessary coordination with the Wyoming State Engineer's Office and/or the State Water Planning Program. Issues such as state water law, existing river basin compacts, and water rights, must be covered within the DES.

14 The DES is remiss in not discussing water quality problems such as increased salinity of the Colorado River. It is
15 essential that the DES adequately analyze whether water quality will be suitable for the proposed impoundments and/or for the

release into nearby streams. The hydrologic characteristics of
16 alluvial valley floors and the possible adverse effects resulting from adjacent operations must also be analyzed.

Land Quality

A major shortcoming of the DES is the failure to provide quantitative information regarding the reclamation of the mined lands. The DES does not include specific explanation of
17 the existing vegetation, ground cover density, potential for revegetation, suitability of topsoil and overburden, and the necessary fertilizers, mulch and organic matter. Little
18 attention is given to the problems of irrigation of the reclaimed areas. The sections regarding land uses and reclamation must be
19 expanded and the issues mentioned above specifically listed and evaluated prior to the final statement.

In conclusion, the state has found the DES inadequate in examining the significant environmental impacts of the proposed mining projects and in providing accurate socio-economic information. Due to the inadequacies, this office recommends that the above mentioned problems be considered and resolved within the final environmental impact statement.

Yours sincerely,

EH/trj

Attachments

cc: Mr. Bob Armstrong

~~Table R4-13~~

ESTIMATED EMPLOYMENT BY SECTOR AND COUNTY WITH THE PROPOSED ACTIONS

1980

Wage and Salary	Lincoln County BLM *	Lincoln County ADAS III 10/77	Uinta County BLM *	Uinta County ADAS III - 10/77	Sweetwater County BLM *	Sweetwater County ADAS III 10/77
Agriculture	203	754 ✓	112	373	212	340
Mining	1,138	871 ✓	517	1285 ✓	6,451	5040 ✓
Contract construction	1,599	695 ✓	793	287 ✓	3,785	1584 ✓
Manufacturing	246	312	330	241	567	392
Transportation, communication, and public utilities	394	335	367	414	1,625	1012 ✓
Wholesale and retail trade	821	681	1,216	863 ✓	4,564	2471 ✓
Finance, insurance, and real estate	86	73	92	72	301	327
Public administration	1,061	869	1,263	1233	2,408	2780
Services	446	273	588	316	3,073	2180 ✓
Other	35	655	11	432	56	782
Proprietors						
Farm	221	—	242	—	100	—
Nonfarm	368	—	347	—	1,202	—
Total	6,618	5518	5,878	5516	24,344	16,928

* Source: Abt Associates 1977.

R4-39

R9-224

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Table R2-47

SOUTHWEST WYOMING ES REGION'S PROFILE OF EXISTING SEWER AND SEWERAGE TREATMENT SYSTEMS

Community	Type of Treatment	Design Capacity	1976 Treatment	Existing Collection System	Identified Problems	Current Compliance with Federal Standards
Kemmerer	Conventional step aeration-activiated sludge process[3]	~~400,000~~ 500,000 gallons per day Avg flow:[3] ~~100 GPCD~~ 540,000 GPD	650,000 to 700,000 gallons per day Avg flow:[3] 186 GPCD	~~Adequate~~ *[3]	Lack of proper maintenance[4] High water use	Not in compliance with 1977 effluent standards[5]
Diamondville	Single cell[3] lagoon system	~~NA~~ 50,000 GPD	~~NA~~ 120,000 GPD	Adequate[3]	none	complies[5]
Evanston		1.8MGD[2]	1.6 MGD[3]	Adequate	Groundwater infiltration overload plant[4]	NA
Lyman	Two cell lagoon[4]	1.2 MGD[4] (pop: 1200)	1.4 MGD[4]	Adequate[4]	Treatment is inadequate[4]	
Mountain View	~~Community~~ septic tank[3] 3 cell aerated lagoon .7MGD	NA	~~Serves half the town~~	None[3]	~~Groundwater & individual wells are being polluted~~[3] will be connected with treatment system	Will not meet new state and federal regulatory requirements for secondary treatment by[6] 1977
Fort Bridger	Lagoon[4]	NA	Adequate[4]	Adequate[4]	Future development would require expansion[4]	Complies[5]

* Large portion of Kemmerer's sewage collection lines are combined with storm sewer resulting in excessive flows into treatment plant during heavy storm runoff periods

Table R2-47

SOUTHWEST WYOMING ES REGION'S PROFILE OF EXISTING SEWER AND SEWERAGE TREATMENT SYSTEMS
(Cont'd)

Community	Type of Treatment	Design Capacity	1976 Treatment	Existing Collection System	Identified Problems	Current Compliance with Federal Standards
Rock Springs	Trickling[9] filter. ANAEROBIC DIGESTER PRIMARY CLARIFIER	1.5 MGD[9]	1.4-1.5 MGD[9] (at peaks 2.2 MGD)	Adequate[9]	Needs expanded treatment facility[5] – UNDER CONSTRUCTION 2 MGD – 32,000 people	NA
Green River	2 ~~privately owned aerated-activated~~ sludge plants[7] Municipal ~~33.6 acre~~ oxidation pond (secondary treatment)[7]	30 lbs. BOD loading per acre per day (pop. 5,100)[7] 2 MGD	48,000 gallons per day 25 lbs. BOD loading per acre per day[7] .75 MGD	Inadequate[4]	Need more treatment & expanded collection system[4] New treatment facilities - not producing quality effluent	Avg. BOD and suspende solids are above 197 standards for maximum allowable discharge; future nitrate and phosphate removal sta dards will also not b met
Granger	Septic tank and leach field[10]	4,700 gallon tank[10]	4,700 gallons[10]	Adequate[10]	Field failed in 1974; growth will require alternative form of treatment[10] Lagoon system planned funding needed	NA

1. Gallons Per Capita Per Day.
2. Million Gallons Per Day.
3. DEPAD, Scenarios, 9/76.
4. DEPAD, Profiles, 10/76.
5. Department of Environmental Quality, Wyoming Water Pollution Control Program for Fiscal Year 1977, 9/76.
6. Uinta Engineering & Surveying, Step I Facilities Plan for Mountain View, Wyoming, 1/76.
7. Parker Associates, Green River Comprehensive Plan, 9/75.
8. Nelson Engineering, Engineering Report on Town of Green River Sewage Treatment Facilities, January, 1974.
9. BBC, An Analysis of Jim Bridger 4 Power Plant Impacts, 1975.
10. Nelson Engineering, Step I Facilities Plan for Granger, Wyoming, 10/76.

NA = Not Available

Table R2-49

SOUTHWEST REGION WATER SUPPLY SYSTEMS

Communities	Water Source	Plant Design Capacity (MGD)	1976 Actual Treated Water Storage Capacity (gallons)	Average 1976 Daily Use (GPCD)	Maximum Daily Use in Summer (GPCD)	Capacity of Distribution System
Kemmerer (including Diamondville and Frontier)	Hams Fork[2] Kemmerer Reservoir #1[2]	3.0[2]	~~730,000~~[1] 2,700,000	490[2]	611[2]	Inadequate[1]
Evanston	Surface[2] WELLS	~~4.0~~ 2.8[2] 2.9	~~2.0~~ million[1] 3.25	350[2]	450[2]	Inadequate[1]
Lyman	Spring[2] (500 gpm)	*		NA	NA	Inadequate[1]
Mountain View	Individual wells[2]	*		NA	NA	Inadequate[2]
Rock Springs-Green River	Green River[3]	12.0[3]	~~2.0~~ 2.5 million[3] GREEN RIVER 8.5 " ROCK SPRINGS	NA	NA	Inadequate[3,4]
Granger[5]	Hams Fork	(8,000 gallon tank) 144,000 GPD or 600 people	~~(none)~~ 500,000 GAL.	NA	NA	~~Inadequate~~

Source:
(1) DEPAD, Profiles, 1976.
(2) DEPAD, Scenarios, 1976.
(3) Parker Associates 1975.
(4) John Dempsey and Associates 1975.
(5) Sweetwater County Priorities Board.

MGD = Million Gallons Per Day
GPCD = Gallons Per Capita Per Day
gpm = gallons per minute
NA = Not Available

* Lyman and Mountain view will share 1500 acre feet/yr of water from the Stateline Dam project when completed

Table R2-50

PLANS FOR UPGRADING WATER SYSTEMS

Community	Water Source	Treatment Plant	Treated Water Storage	Distribution System	Financing
Kemmerer (including Diamondville and Frontier)[1]	May purchase up to 1,000 area feet of water annually from Lake Viva Naughton	Currently adding 2.0 MGD capacity	2.0 million gallon tank ~~under construction~~ already constructed		
Evanston[1]		~~Plans additional~~ 4.0 MGD capacity	One 1.0 million gallon tank One 0.25 million gallon tank	Repair, upgrading and expansion currently underway	Farm Loan Board loan (debt service - 1% county sales tax revenues and increased water rates)
Lyman-Mountain View[2]	Will purchase 1,500 acre feet per year from Bureau of Reclamation (available 1979 or 1980)	Construct 1.44 MGD capacity plant		Mt. View plans new distribution system but no funding yet	Farm Loan Board will finance plant
Rock Springs-Green River[3]		(Adequate until 1985)	Must be increased in case of new development	Must be extended if new development occurs	New projects would need state and federal funds
Granger[4]	Will construct dam on Hams Fork Will construct pipeline from FMC Trona plant to deliver Green River water	Will construct package water treatment plant	Will construct ~~2,500~~ gallon water tank	EDA FUNDED DISTRIBUTION SYSTEM IMPROVEMENTS COMPLETED	Combined HUD-EDA grants if EDA grant is approved; otherwise will use HUD grant and bond the rest

Source:
(1) DEPAD, Profiles, 1976.
(2) DEPAD, Scenarios, 1975.
(3) Parker Associates 1975.
(4) Sweetwater County Priorities Board.

MGD = Million Gallons Per Day

Letter 50 Responses

1. The population projections throughout the document have been revised to show the most recent data available. Abt Associates, the consulting firm employed, provided new projections in March 1978.

2. Employment projections throughout the document have been revised to show the most recent data available. Abt Associates, the consulting firm employed, provided new projections in March 1978.

3. Table R1-2 revised.

4. Income projections throughout the document have been revised to show the most recent data available. Abt Associates, the consulting firm employed, provided new projections in 1978.

5. Text revised (see Table R1-1, Regional, Chapter 1, for base data used in Socioeconomic Conditions sections).

6. The ES could be a tool used along with other information available to local governments (i.e., through local planning organizations, etc.). While it may not be complete in every detail, it does provide insight to the socioeconomic problems and impacts which are expected to occur within the ES region.

Specific data and contract reports obtained from Abt Associates, the socioeconomic contractor, are also available for use by local governments at their convenience at the Rock Springs District Office of the BLM. These data and reports were used as a basis for preparation of the ES and are available for public use.

In addition to the above, the Secretary of the Interior has recently established a task force to review the Department of the Interior coal management program. A primary objective of this effort is to explore new coal policy procedures which will minimize social and economic impacts of coal development on local communities.

In any decision concerning the proposed coal mines, the impacts on socioeconomics and the views and opinions of local government officials would be considered along with all other pertinent information.

7. The entire Socioeconimic Conditions sections of the document have been revised to show the most recent data available. Abt Associates, the consulting firm employed, provided updated information on the existing situation in February 1978.

8. See response number 6.

9. The data for law enforcement, fire protection, and the tables concerned have been revised to show the most recent data available. Abt Associates, the consulting firm employed, provided new data in February and March 1978.

10. Text revised in all chapters, Regional and site specifics, to reflect the Clean Air Act Amendments of 1977. Letter number 13, comment number 3, addresses the comment of best management practices to reduce fugitive dust.

11. Several changes have been made (see Regional, Chapter 1, Other Major Regional Developments, and Regional, Chapter 4, Water Resources, Surface Water).

12. The impacts due to the proposed actions are considered minor for the following reasons:

1. Impoundments on mine sites are small compared to the drainage area of the Green River system.
2. All proposed mine sediment holding ponds are on ephemeral tributaries.
3. Major diversions due to the proposed actions would be for municipal supply and amount to 5,040 acre-feet per year by 1990, of which about 4,030 acre-feet would be returned to the system as treated sewage water.

13. Statement of cooperation is included in Regional, Chapter 9, and references to the Wyoming State Engineer's Office in Regional, Chapters 3 and 4.

14. The salinity problem is addressed in the Regional, Water Resources, Surface Water sections. Quantification of the increase in salinity caused by the proposed actions would be at best a guess. The increase in withdrawal would be 5,040 acre-feet per year by 1990. The flow of the Green River near Green River is about 1,254,000 acre-feet per year. The withdrawal would be about 0.4% of the average discharge and the estimated return would reduce that even more.

15. Water impoundments are proposed for use on the mine sites. This water would be evaporated or consumed on the site. Impoundments are proposed to remain on the Black Butte site after reclamation. This possibility will be tested for suitability before this plan is definitely adopted. It is not likely that the proposed pond at the Twin Creek site will contain water. All other sites proposed will retain water along minor drainages for stock use. Discharge to major drainages is not anticipated.

16. Text revised (site specifics, Chapters 2, 3, and 4, Water Resources, Surface Water).

17. The discussion of vegetation types and common plant species found within the types was considered an adequate descriptive treatment of vegetation resources for impact analysis. Guidelines are provided mining companies for premining and postmining vegetation inventories by the Wyoming Department of Environmental Quality (DEQ). These guidelines require gathering data for vegetative composition and production which are submitted to DEQ. Soil Conservation Service criteria were used in rating topsoil and subsoil for reclamation suitability. The available soil resources appear adequate to effect the revegetation of proposed mined lands. Proposed fertilizer and mulch applications are presented in the site specifics, Chapter 1, Reclamation. The actual application of these plant growth and soil improvement treatments would and should depend on on-site and off-site research findings.

18. Potential problems are recognized in mined-land reclamation literature. Current reclamation research indicates that careful, judicious irrigation can result in the establishment of native vegetation with satis-

factory cover and density. It is generally accepted that the presence of seeded and (or) planted plant species for at least 2 growing seasons constitutes successful plant establishment (Aldon 1978, Bengson 1977, Aldon and Springfield and DeRemer and Bach (Thames ed. 1977), and (Vories ed. 1978)).

19. The site specifics, Chapter 3, Vegetation sections have been revised. The expansion of land use sections was considered and not felt appropriate. Text revisions have been made where deemed necessary or appropriate in regard to "issues mentioned above," (see specific responses to other comments in this letter).

51

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Game and Fish Department

CHEYENNE, WYOMING 82002

EARL M. THOMAS
DIRECTOR

Re: 400478
ES 17

Routing 6/3/78 Initial & Date

1	SD	
2	ASD	
3	P&EC	
	OPA	
	Res.	
	Tech S.	
	Mgmt S.	
	CF	
Lead Resp.	3	

June 28, 1978

Mr. Dan Baker
State Director
Bureau of Land Management
P.O. Box 1828
Cheyenne, Wy 82001

Dear Mr. Baker:

Having reviewed the Southwest Regional and Site Specific Coal EIS's, we offer the following comments in the interest of the wildlife resource.

In general, the documents give inadequate consideration to terrestrial and aquatic wildlife. Much of the information provided BLM under contract was either not used or used incorrectly. Some wildlife losses were documented;however, they were, in essence, just written off as minor losses necessary for coal development. Inadequate consideration was given to avoidance and mitigation of impacts as well as to cumulative, long term, and off site effects on wildlife resources.

1 We suggest use of a table of wildlife impacts like the one provided with our final SW EIA contract report. It is inaccurate to assume that impacts on a mined area will be insignificant because the number of animals affected will be small in comparison to all the animals in a BLM district. We are concerned that small impacts to individual populations over a whole district may be large impacts to the entire populations.

2 In each of the mine and reclamation plans, wildlife have been sacrificed in favor of livestock. Current Federal land management policy stresses multiple-use management, including wildlife.

3 Some of these leases do not resemble the areas originally surveyed for inclusion in this document. Since all of the originally-proposed areas will eventually be mined, we believe the entire lease areas as originally proposed should be evaluated.

51

Wyoming Game and Fish Department June 28, 1978

4 Descriptions of vegetation on mine sites should be site-specific, not general. Vegetation data collected on-site should have been used in this document.

5 Cumulative impacts are not considered in this EIS. The only other developments mentioned are nearby coal mines, yet there will be extensive trona, coal, oil and gas, and gravel mining in this region. The cumulative impacts on vegetation, wildlife, soils, air and water quality, socioeconomic, and aesthetics of all of this development should be more adequately quantified. More positive language and less generalization should be used in the EIS.

The following specific comments on the Regional and Site Specific EIS's are in order of pagination of the reviewed documents.

Regional Analysis

6 The phrase "mid-level production" is misleading. Although this level is between the low and high levels of coal development, it is actually nearly the same as the high level development. The difference between "mid-level" and "high level" is about 3 million tons of coal or 10% of the 31 million tons proposed for high level production while low-level production is only 13 million tons.

Page R1-7, Coal Related Development: Enlargement of the Naughton Power Plant is estimated to further deplete 12,900 acre feet of water annually from the Hams Fork. Effects of these proposed flow depletions on the Hams Fork fishery should be included as should measures to minimize impacts.

Page R1-9, Water Developments: The paragraphs under this heading are out of place as they do not address this proposal (see main page heading). They address existing or planned situations outside the proposal (i.e. "future environment without the proposal.")

Page R1-10: Table R1-3 is in error. Tenneco, Inc. intends to open a new trona mine south of Little America in 1979 or 1980. It is not included in the table.

7 Page R1-13: The assumptions are made that reclamation of mined lands will take nine years, four of which is for backfilling, spoil shaping, etc. and reclamation of areas not mined will take about eight years, without extensive backfilling. The delay in reclaiming unmined areas such as rights-of-way should be accounted for.

8 If irrigation is employed to speed up reclamation, there is the very real possibility that all plants will die when irrigation ceases.

Page R2-37, Surface Water: Relationships of industrial, irrigation and municipal demands on water quantity (instream flows) in major streams should be covered here.

9 Page R2-41, Aquatic Habitat Types: The description of the existing aquatic environment is too general to be meaningful.

10 Page R2-41, Terrestrial Habitat Types: It should be noted that mountain shrub, broadleaf trees, grassland, and greasewood also support bird species. There is no mention of beaver, otter, mink or muskrat in riparian areas.

11 Page R2-42, Nongame-Game Fishery: The first three paragraphs are contradictory and misleading. As we understand Dr. Baxter's statement, it is used out of context. His figures were intended to reflect a generalized estimate covering many waters. These figures are misrepresented in the ES as "the best population density estimate currently available." Paragraph three mentions game species present as determined by the Game and Fish Department. This is followed by another "estimate" from Dr. Baxter. We suggest that actual standing crops determined by our Department and included in a report to BLM dated December 1977, be used.

12 Page R2-42, Sensitive Species: The section should mention that the two subspecies of cutthroat trout considered depleted by the Wyoming Game and Fish Department are also considered as sensitive by the BLM and, as such, warrant special consideration in activities on BLM lands.

13 Page R2-42, Wildlife: Riparian habitat (broadleaf trees) does not necessarily occur over large areas, but from the standpoint of wildlife diversity, it is a "primary" habitat type.

14 Birds: Although Dr. Diem is certainly a competent ornithologist, we know that he was not aware of being cited herein when he gave you verbal estimates of species density and diversity per acre. We believe that the estimates made from breeding bird transects run by Wyoming Game and Fish Department personnel in June 1977 and before are much more valuable than the estimates used.

We do not believe that an estimate of species per acre for combined habitat has any value. A habitat type with few species per acre is not necessarily less valuable than one containing more species per acre. There will always be fewer animal species in a type with less vegetative diversity, but the type may be extremely valuable to species that only occur in that type. These habitats are distinct entities, as the species lists on Page R2-41 indicate. We do not believe they can be combined. It would, however, be valuable to know relative densities of animals in various habitat types so that the relative value of each type within the region could be assessed.

Some mention should be made of the fact that the number of raptors found were on and adjacent to site-specific areas so the reader does not think the number was for the entire region.

Page R2-43, Table R2-17: Raptors surveyed should include the long-eared owl, the merlin, and the saw-whet owl.

15 Page R2-45, Mammals: Furbearers, badger and bobcat should be included.

16 Sensitive Species: The status of species listed by Wyoming Game and Fish Department as rare species is not mentioned in this section. Table R2-20 is identical to Table R2-18.

17 The source for information included in Table R2-19 should be pertinent research such as Maxell (1973) rather than a personal communication from sources who have done little or no research in southwestern Wyoming. We do not believe that

18 the numbers of species in the mountain shrub, aspen-cottonwood, and juniper types are accurate. The section on habitat types on Page R2-41 lists more species for most of these types than are indicated here.

19 Page R2-57, Recreation Resources: We do not feel that the short paragraph on hunting adequately describes either the economics or the recreational value of hunting in the coal EIS region. They could be explained in much more detail.

20 Page R2-96, Fish and Wildlife: We commend the implementation of one of our comments on the Preliminary DES. The quantified estimate of project effects on wildlife, aside from the statement that wildlife will be "displaced", is appropriate. Estimated losses are usually based upon the number on-site and seldom exceed the number of animals on-site in one year. Actual losses are due to lost reproductive potential, and equal the number of animals on-site, their offspring , those animals' offspring, and so on. The figures given here for estimated losses of animals are impressive and in perspective with the figures for project benefits. Although we have some reservations about whether or not they should be larger, we are glad to see such figures used.

Page R2-98, Recreation Resources, Other: Perhaps, instead of closing areas near urban centers to ORV use with the possibility of diverting such activity to untouched areas, the solution is in creation of ORV parks to regulate off road vehicles.

Page R3-7, Institutional Relationships, State and County: The Wyoming Game and Fish Department should be listed as the State Agency responsible for wildlife management.

Page R4-11, Topography: The eighth paragraph mentions that "the two largest natural water courses in the disturbed area would remain in approximately the same position." The next sentence states that "All tributaries to them and all other lesser water courses would be obliterated." The next two paragraphs contain similarly vague statements of destruction -- e.g. "many of the larger water courses would be moved, straightened, rerouted or otherwise modified." These statements should be explained in terms of impacts to the streams and to receiving waters. The impacts should be quantified. We are concerned that cumulative impacts may result in unacceptable losses both on-site and to receiving drainages.

21 Changes in topography on the various mine sites are likely to have significant impacts upon both vegetation and wildlife. Those species of plants and animals which occupy broken or steep topography will not be accomodated on mined areas following mining. The result will be lowered diversity and density of some species, and complete elimination of others.

Page R4-12, Soils: Paragraph two states that increased erosion would occur and that "a portion could end up increasing the sediment load in the Hams Fork." The severity of increased sediments on the Hams Fork must be addressed. Significant sediment increases must be avoided.

Paragraph three, the last sentence, indicates "an accelerated rate of erosion will occur from wind and water on areas of disturbance." Cumulative effect on streams should be quantified.

Page R4-12, Water Resources: Do the "withdrawals" mentioned immediately below the heading consist of groundwater, surface water or a combination of both? The anticipated impact of the "withdrawals" on aquatic ecosystems should be analyzed.

Page R4-15, Surface Water: The impacts presented in the first paragraph should be further explained. The second paragraph (continued on P. R4-18) mentions the release of water pumped from the mines or from industrial plants. It should note that this will be allowed only if the water meets Wyoming water quality standards. This paragraph and the next also mention sediment introduction, channelization, etc. but cumulative effects, including those on downstream waters with fisheries, are not quantified.

Losses of surface impoundments, such as those on areas like Black Butte which are vital to the existence of big game, sage grouse, and many non-game animals, are not mentioned.

Page R4-18, Surface Water Quality: Increased total dissolved solids in streams below mines are mentioned and should be quantified. Increases that would adversely effect aquatic ecosystems are unacceptable and must be prohibited. The third paragraph under this heading mentions further discharges of wastewaters. These must meet Wyoming's water quality standards. The ES states that "Data are not available to assess the impact that sewage effluent would have on stream water quality in the coal basin if the effluent were released directly to streams." Data are available, however, to allow fairly good predictions, which should be provided prior to approval to mine an area. It is unacceptable to allow mining to begin without fulfilling this responsibility and then request that the operation be allowed to continue because of the dollars already invested in the mine or the need for energy.

The next to the last paragraph under this heading indicates increased sediments, spoil piles, areas demanded by construction, and channelized stream courses as mainly local effects. This represents inadequate coverage of the topic. Other statements in the ES lead us to believe the total effects may be significant or unacceptable on all drainages downstream.

Page R4-20, Aquatic: The last paragraph, first column, makes a statement too general to be meaningful. A lack of data is used as a reason for not addressing actual impacts. It appears that the necessary data would come from descriptions of mining activity. These data must be made available and analyzed before mining is permitted. The general statement should be expanded further to discuss the general health of aquatic communities (plant or animal) as an indicator of stream health. The impacts that proposed sedimentation and stream obliteration would have on stream ecosystems should be defined.

22 Page R4-20, Terrestrial Vegetation: It is inconsistent to discuss water acquisition problems and the area's aridity in one section of this EIS and then propose to irrigate revegetated land in another.

23 This section points out that,from a wildlife standpoint, there will be no reclamation in the foreseeable future, and perhaps never. A solution to this problem is not allowing mining until the area can be reclaimed. We maintain that an area changed from shrubland to grassland cannot support the pre-mining land use, and thus violates the Surface Mining and Reclamation Act of 1977.

24 Page R4-20, Habitat Losses: The statement, "Because reclamation would take place simultaneously with mining, not all this acreage would be lost to wildlife habitat at one time" is much too optomistic, if not untrue. The section on Terrestrial Vegetation says revegetation will be very difficult to accomplish. As we have previously pointed out, revegetation to grassland will, in fact, restore very little wildlife habitat. Most of the area may be devoid of wildlife at the end of mining and will remain so until succession occurs, if it does occur.

25 Page R4-21, Table R4-7, Summary of Impacts on Fish and Wildlife Resources from the Proposed Actions : The tabulation presented is misleading as it considers only the "area directly involved." Areas of immediate influence would change the fisheries impacts to "major" concern. The table notes that insufficient data are available to determine the percent of impact of the proposed actions to total cumulative impacts on fish. Fisheries population information is available and evidently adequate mining details are available as percentages were determined for other wildlife.

26 Page R4-22, Table R4-8, A Summary and Comparison of the Fish and Wildlife Area Impacted by the Proposed Actions Compared to the Total Cumulative Actions: This table should be revised to include fishery habitat in a meaningful way. Were streams converted to acres and added to land acreage?

27 Page R4-23, Table R4-8A, Summary of the Fish and Wildlife Population Losses: Game fisheries losses are misrepresented. The economic losses are low by about a decimal point, assuming the rate of loss in the table and the dollar value on the following table to be correct. If a constant rate of loss occurs from 1985 to 1990, the total loss is 96 thousand fish, not 27 thousand. Losses occur each year. With our estimates of fishing pressure that can be supported by this number of trout, and the economic value per fisherman day, the loss comes to $718,000 by 1990, not $250,000 as shown in the table.

28 Page R4-24, Table R4-8B, Value of Fish and Wildlife Resources in Wyoming: The source of these data is "Estimates of 1976 Expenditures in Wyoming by Hunters and Fishermen", Planning Report #8-A, Wyoming Game and Fish Department, 1977. There are some inaccuracies in the table. Upland game should be birds and waterfowl. The resident expenditure for deer is 24.89, rather than 24.87. Sheep have been deleted from this table. If turkeys, which do not occur in the region, are going to be included, sheep should be included. Resident sheep hunters spend 34.52/day, nonresident sheep hunters 174.30/day for an average of 66.37/day.

The contribution of the two major types of nonresident fishing licenses are not recognized. The value listed for nonresidents in the Table is actually for the tourist 5-day fisherman. Nonresident season license holders expend slightly more per fishing day than residents and should be included.

29 Page R4-25, Carrying Capacity Losses: Carrying capacity is usually expressed as a number of animals per unit area, not as a number of acres. The statement that the loss of carrying capacity will be
30 reduced if reclamation is successful is unsubstantiated by successful reclamation anywhere in this area, contrary to statements in the EIS.

Page R4-26, Birds; The Wyoming Game and Fish Department contains some of the "professional expertise" mentioned here and we do not agree that the best estimates of bird densities for southwestern Wyoming come from the unsupported opinion of one ornithologist.
31 Density information collected during the summer of 1977 is better information. Our records show that at least eight sage grouse strutting grounds used by over 400 males will be lost to mining. This means that many more than the numbers given here will be lost.

32 Page R4-27, Mammals: The source for the density estimates given for mammals should be cited. Data from research done by Marvin Maxell, 1973, University of Wyoming should be used.

Economic losses here do not accrue to the animals as indicated but to the State. These are economic losses as a result of lost consumptive and non-consumptive use opportunity.

Page R4-53, Law Enforcement: There will be a greater need for wildlife law enforcement in this area as human population increases. We have already seen marked increases in wildlife-related offenses in impacted areas of Wyoming.

Page R5-2, Unavoidable Adverse Impacts: The last sentence of the second paragraph should read, "Economic losses to the state as a result of lost hunting and fishing opportunity would be $976,900."

33 Page R6-1: The fisheries losses depicted in items 5 through 9 of the short-term effects and item 3 of the long term effects are unacceptable. We do not believe that wildlife habitat losses will be short-term losses. This section is not correct. An effect is either short-term or long-term, not both. For example, the decrease in the amount of "primitive" quality recreation cannot be both short-and long- term.

Page R7-1: The irreversible and irretrievable losses to fisheries are unacceptable and must be avoided.

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Wyoming Game and Fish Department June 28, 1978

Page R8-18, Fish and Wildlife Alternative: We support this alternative; but have some doubts about its implementation. It is unfortuante that mitigation was relegated to alternative status in this DES. We would have liked to see it included as part of a regional mitigation section. However, there is no mitigation section in this regional document.

It's obvious from the impacts involved with the development that some mitigation is necessary. Our concern over the proposed mitigation is whether there is habitat of the same type and quality adjacent to each mine site. It may be more logical to select similar areas whereever they occur in the region. For example:

1. Off site mitigation measures such as water development in desert areas and habitat improvement on winter ranges should be considered and should be funded by the mining companies.

34

2. If there are equal streams in adjacent lands, they are likely to presently support fish populations in balance with available habitat.

3. Effectiveness of artificial nesting sites for raptors should be documented and included with the suggestion that such sites be used to replace existing nests.

Enhancing habitat faces many problems including costs, complications and time in dealing with various agencies, maintaining flows, etc. The basic premise that it is better, overall, to maintain those good habitats that now exist than destroy them and construct a substitute is applicable.

We support alternatives to "greatly reduce or totally eliminate the major impacts to existing fish and wildlife populations" as proposed. We disagree, however, that this can satisfactorily be done by enhancement of the habitat and carrying capacities of those lands adjacent to the proposed mining operations.

SITE SPECIFIC AREAS

North Block Mine

The North Block Mine operation will intersect a small, intermittent stream and several seasonal drainages. In addition, it is still proposed to use the Hams Fork flood plain for "storage" of overburden (p. NB2-8) in which the spoil piles may be less than 200 feet from the stream (NB3-13). Overburden, or spoil pile storage, apparently to occur on Kemmerer Coal Company land to the east of the North Block Coal lease, may involve much more riparian area than originally judged. Assorted dams, water storage facilities and diversions are planned to control pollution and turbidities; 35 however, it is conceded that the silt load of the Hams Fork will be increased (p. NB5-3) with adverse impacts to fish and other aquatic life (p. NB3-13). It is also stated, "Flood flows may reach and severely erode the recontoured spoil piles," and that, "It is impossible to quantify impacts with available data" but then suggests a 50% loss of game and non-game fish will be assumed (p. NB3-19). Such losses are unacceptable. The loss could be either considerably less or near a complete loss depending on how diligently the mining company pursues their control programs and on weather conditions.

Page NB2-14: We do not agree that the same primary wildlife species occur in mountain shrub, aspen, broadleaf trees and sagebrush vegetation types. Some cosmopolitan species may inhabit several vegetative types but most species will primarily inhabit one type.

Dr. Baxter is quoted as estimating fish populations for the Hams Fork (NB2-14, NB3-18 etc.). Refer to previous comments on this 36 topic in the regional analysis. Wyoming Game and Fish Department standing crop inventory figures should be used.

Page NB2-15: Wildlife data provided under contract concerning 37 raptors and prairie dog towns on-site have not been included in this section. Wildlife data is lacking in this document.

Page NB2-18: One-half mile of stream is listed as the amount of stream on public lands where access by fishermen would be lost because of the mine (p. NB2-18). Reference is made to the shortage of recreation facilities and the fact that many people leave the area because of this and may cause a high turn-over rate among employees (p. NB2-30). With this acknowledged loss of access and with the admitted probability of damage to the Hams Fork fishery some mitigation should be offered. This is not the case, however. The expected loss of fisheries is apparently being written off with no further consideration.

The Kemmerer Coal Company will be operating the North Block Mine and the Twin Creek Mine. They also have considerable private holdings in the area. We suggest, as a mitigating measure, they guarantee public access to the river where it is on their land.

38 Page NB3-1: Our comments on the regional section of the EIS concerning reclamation and irrigation of reclaimed areas also apply here.

39 Page NB3-14: There should be clarification of the statement that reclamation has been accomplished on highway rights-of-way and areas disturbed by oil and gas activities. Revegetation on these areas is for a different purpose. This section should

40 include a reference to proposed seed mixtures for reclamation, and exact procedures to be used in revegetation. The whole section is general and very speculative. SCS recommended reclamation is seldom beneficial to wildlife.

41 Page NB3-18: The economic loss and loss of fish is calculated through 1990 (NB3-18, NB5-3, NB6-1 35c), which is determined to be the end of the mine life. Environmental impacts will last far beyond the life of the mine and no spontaneous recovery of fish populations can be expected when the mine closes.

42 Pages NB4-1 and 2: We note that there is no wildlife mitigation included here. We believe wildlife should have been considered in this section by mitigating measures, on or off-site.

43 Page NB5-3: We do not agree that vegetation changes are unavoidable. Under current law, modification of vegetation composition is allowed but it is not completely unavoidable.

Page NB5-5: We question the recreational value placed on viewing the mining activities considering the safety factors involved.

Page NB8-4: We support the Hams Fork Protection Alternative. Under this alternative, it is suggested that, should the alternative be approved, the coal in the area would not be recovered and the Viva Naughton plant would have to find a new source of coal several years sooner and overburden would not be stored on the Hams Fork riparian area. We are disappointed to see Table NB8-3 listing suggested plant species for reclamation relegated to non-status.

Twin Creek and South Haystack Mines

The Twin Creek Mine and the South Haystack mine do not involve fisheries on either site. Each statement concedes the inevitable generations of turbidities into their respective drainage systems despite the use of catch basins and other erosion control procedures, (refer to pages TC1-10 and 11, TC1-20, TC3-9, TC3-11, TC5-1, TC5-4, SH1-13 and 14, etc.) but only casual reference is made to possible impacts to fisheries located down drainage from the sites (pages TC-3 and 10 and TC5-4). Page SH3-14 states no loss of game fish would occur. While this is true on-site, the mine could have an influence on the overall health of the aquatic resources in the drainage and could contribute

to the eventual loss of game fish production capabilities. The same situation applies to the Twin Creek Mine.

Twin Creek

44 Page TC1-3, Predisturbance Surveys and Analyses: The Wyoming Game and Fish Department conducted wildlife and vegetation inventories in this area. The data should be used.

45 Page TC1-13, Reclamation: Proposed reclamation measures will ensure that little wildlife habitat remains in this area.

46 Page TC1-19, Table TC1-6, Recommended Seeding Mixtures in Pounds of Pure Seed per Acre: The seeding mixtures included here will be largely worthless to wildlife and do not resemble the plant composition on-site before mining, as illustrated on pp. TC2-9 and 10. Those wildlife species on-site before mining will not return after mining if the proposed reclamation plan is successful.

Page TC4-1, Mitigating Measures: Again, there are no mitigating measures for wildlife, although nongame species will be severely impacted.

Page TC8-3, Table TC8-2, Recommended Vegetation for Reclamation of Twin Creek Mine: Recommended plant species for reclamation have been included only as an alternative. All species currently growing on site are likely to grow after mining and should be re-established.

South Haystack

47 Page SH1-12 and Table SH1-6, Seeding and Revegetation: The seed mixtures here are totally inappropriate from a wildlife standpoint. The addition of 0.1 pounds of sagebrush in a mixture of 12.1 or 13.1 pounds of seeds is not adequate for wildlife. The chance of that small a percentage (0.8%) of sagebrush seed being able to grow in competition with the other seed in the mixture is extremely minute. Since 92% of this site is covered by tree and shrub vegetation types, we see no relationship between premining vegetation and the reclamation mixture.

Page SH2-16, Birds: We question the statement that there may be as many as five minor sage grouse strutting grounds scattered throughout the area. There are five other sage grouse strutting grounds on this mine site--a total of seven--but they are not minor. They may be smaller, but small strutting grounds may be very important as breeding sites. Until someone proves that these are "minor" they should be referred to as smaller grounds. What is the documentation for the statements that these grounds are occupied by yearling males and that little breeding takes place on these grounds?

48 Page SH2-18, Mammals-Game: The mule deer migration route across this site is not mentioned here.

49 Page SH3-10, Vegetation: This section and the vegetation sections from the previous two mine plans are identical. A reclamation plan should be site-specific.

50 Page SH3-14, Wildlife-Birds: What is the basis for assuming three female sage grouse use a strutting ground for each male?

51 Page SH5-4, Vegetation Impacts: These impacts are identical to those for Twin Creek and North Block, however, impacts are site-specific.

Considering the large amount of public land on this lease, we are concerned that BLM would restrict access to the whole area when the company is mining small acreages at a time.

52 Page SH7-1, Irreversible and Irretrievable Commitments of Resources: Most of these involve wildlife. The impacts, the wildlife resource commitments, the inadequacy of reclamation, and the lack of wildlife mitigation raise serious doubts about the suitability of this area for mining.

Long Canyon Mine

This mine will be an underground mine so the majority of the disturbed land will be for roads, railroads, power lines and buildings. The major impact to fisheries from these disturbances will be sediments that enter the waterways.

53 Page LC1-11, Planting and Revegetation: Since shrubs are the dominant species, rather than native wheatgrasses, in the area to be disturbed, we believe that some shrubs should be used in reclamation.

54 Page LC2-15, Mammals-Endangered and/or Threatened: The Game and Fish Department did not conclude that there were no black-footed ferrets on this site, although this section implies that we did.

Page LC2-29, Recreational Resources: Table LC2-9 is mislabeled. It does not depict increased recreational use.

Page LC3-8, Drainage: The last sentence of the third paragraph states, "This gullying would not significantly modify the overall topography." We believe the erosion causing the gullying will affect the water quality coming out of the area.

At the end of the life of the mine and before reclamation is complete, there is a good probability that a large amount of erosion and subsequent siltation will occur. Subsidence, as it occurs at the mine site, may accelerate the erosion for a period of time. The sediments that originate from the mine site will eventually end up in the Green River.

Pages LC4-1 and 2, Mitigating Measures 1-7: Again, there are no mitigation measures for wildlife or wildlife habitat.

Page LC5-1, Adverse Impacts Which Cannot be Avoided - Vegetation: Except for one number, this section is identical to all of the other mines. As stated before, impacts are site-specific, and the section on vegetation impacts should discuss site-specific impacts.

55 Page LC5-3, Recreation Resources: We do not support blocking recreational access to any areas but the immediate vicinity of the Long Canyon mine. This is checkerboard land, and the public has the right of access to the public land sections not being mined.

Black Butte Mine

Page BB1-4, Predisturbance Inventories and Analysis: Is the black-footed ferret search described here the one conducted by the company or the one conducted by the Game and Fish Department? The results of our survey revealed neither the presence nor the absence of black-footed ferrets.

Page BB1-12, Watercourse Diversions: The first two paragraphs state that runoff will be diverted into ditches to divert the water around the mining operations. These ditches will cause erosion problems. Silt from this erosion will be carried down Bitter Creek and eventually into the Green River.

Page BB1-18, Table BB1-8, Seed Mixtures for Black Butte Project Revegetation: Although the seed mixtures proposed here will not completely restore the vegetation composition, they will reestablish shrubs valuable to wildlife on the Black Butte mine site.

Page BB2-20, Table BB2-9, Raptor Species and Abundance Classification: What is the source of the data in this table? It is not logical to list the abundance of raptors based upon locating their nests. It is very difficult to locate the nests of the marsh hawks and kestrels, so they will not be listed in the status which reflects their abundance. On the Black Butte area in 1977, both species were very abundant, but few nests were located.

Page BB2-39, Water and Sewer Systems: The Green River sewage treatment facilities have been expanded but do not seem to be working adequately at this time. With the increased population, expansion of the treatment plant may have to be undertaken in a relatively short period of time.

Page BB2-49, Water, Sewer and Utilities: Water and sewage facilities will probably have to be expanded in the near future because of the moving, straightening, rerouting and modifying of watercourses. This could have an impact on the fisheries of Bitter Creek through increased sedimentation. This sedimentation could also eventually affect the Green River and Flaming Gorge Reservoir.

56 Page BB3-21, Fishery: The ES states that no loss to game fish is anticipated but some loss may occur to the nongame fishery if large amounts of sediment enters Bitter Creek. Game fish use of lower Bitter Creek and possibly Flaming Gorge Reservoir could be affected.

Page BB4-1, Wyoming Department of Environmental Quality: Black Butte Mitigating Measures No. 3 and 4 are not mitigating features. They indicate that samples will be taken and analyzed but application of actual mitigation measures is not defined.

Page BB5-1, Groundwater: Lowering of groundwater levels could possibly cause springs to dry up thus decreasing the flow of Bitter Creek.

57 Page BB5-3, Vegetation: This vegetation section does not reflect the actual situation after reclamation. This area will not have the appearance of grassland, because shrubs have been included in the reclamation plan.

58 Page BB5-4, Recreation Resources: We do not believe the number of people coming to view mining at Black Butte will be significant.

Long Canyon and Black Butte Mines

Suspended sediment can play an important part in the water quality of the area as a carrier of phosphorus, metals and soluable salts. Many sediments that originate in the mine areas will end up in the Green River and Flaming Gorge Reservoir. The Type IV study done by the Soil Conservation Service shows the general area of the Long Canyon and Black Butte Mines to be in areas having moderate to heavy erosion rates. Any increased erosion in these areas could have a detrimental effect on the water quality in the Green River and Flaming Gorge Reservoir.

Wyoming Game and Fish Department June 28, 1978

Appendix

59 Wildlife distribution map 8 is incorrect. The elk distribution in the Little Mountain-Pine Mountain area is wrong. There is crucial elk habitat in the area.

Wildlife map 8A is also incorrect. All of the sage grouse strutting grounds are not indicated on South Haystack. Strutting grounds on or near Black Butte are not indicated. Raptor habitat and prairie dog concentrations on or near South Haystack are not indicated.

The increase in the resident population because of these mines will have an impact on the fish and wildlife population in the area through expanded use. A large number of people come to work in Wyoming because of the wildlife resources. The work that draws these people here, as well as the people themselves, will affect the quality of the recreational resources. Since people will travel long distances in search of recreational opportunity it can be expected that entire western Wyoming will be impacted by the new residents of the Rock Springs - Green River area.

Please contact us if we can be of further assistance in making the final Environmental Impact Statement more complete and accurate in consideration of Wyoming's wildlife resources.

Sincerely,

Bill Morris

Bill Morris,
Assistant Director
Wyoming Game and Fish

BM:HBM:kjt

cc: SPC
Game Division
Fish Division
Don Dexter
U.S. Fish & Wildlife

Letter 51 Responses

1. Text revised (Regional, Chapter 4, Fish and Wildlife).

2. The site specifics, Chapter 4s. present seed mixtures and potentially needed seed methodology which would enhance the reclamation of wildlife habitat. The Wyoming Game and Fish Department was involved in the development of the proposed Black Butte seeding mixture.

3. Only those areas proposed to be mined in the mining and reclamation plans submitted to the District Mining Supervisor of the USGS prior to February 1977 were analyzed.

4. Vegetation types, their approximate acreages and a listing of common plant species within the types appears in each site-specific description of vegetative resources.

5. Estimated impacts of developments other than the proposed actions, are discussed in the Regional, Chapter 8, High-Level Scenario.

6. The final ES has been changed to talk of the "most probable level," not the "mid-level."

7. The soils, climate, and other problem factors (mentioned in the Vegetation sections, Regional, Chapter 4, and site-specifics Chapter 3, affecting reclamation would also exist for rights-of-way.

8. Long-term research results concerning supplemental irrigation within the ES region are unavailable. At a coal mine in the arid southwestern United States, a stand averaging 25 native grass plants per square meter was established three years after initial seeding and following a 9-inch application of water during the initial growing season (no further watering was done). Four-wing saltbush seeded with the grass averaged 1 plant per square meter (Aldon 1978). This study and other studies cited in the site specifics, Chapter 3, Vegetation sections, (see Appendix D, Regional, for a complete description of the literature cited) indicate that supplemental irrigation can be used to effect successful plant establishment on arid and semiarid mined lands.

9. Detailed descriptions of existing situations were given only for those resources that would be significantly impacted.

10. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of habitat types).

11. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of nongame fishery).

12. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of sensitive species).

13. See response number 11.

14. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of nongame birds).

15. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of nongame mammals).

16. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of sensitive species).

17. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of nongame mammals).

18. Text revised (Regional, Chapter 2, Fish and Wildlife, discussion of habitat types).

19. Only those resources that would be significantly impacted by the proposed actions were described in detail.

20. Text revised (Regional, Chapter 4, and site specifics, Chapter 3, Fish and Wildlife, discussion of population losses).

21. Plant species composition, cover, and density changes would occur if mining is conducted (site specifics, Chapter 5, Vegetation sections). North, south, east, and west exposures would still exist following mining. Overall reductions in slope steepness would in future years tend to enhance higher forage production than would be obtainable prior to mining. A majority of the plant and animal species in the region exhibit an ability to occupy transitional zones rather than being restricted to a particular niche.

22. Supplemental irrigation would not require large quantities of water in comparison to other water uses in the ES region. Water would be obtainable from the mine pits and (or) wells. Assuming sprinkler irrigation would be employed by all five proposed mines and that 6 inches of water would be applied per year and given the approximate average annual acreage disturbance of 700 acres, then the average annual water budget would be 350 acre-feet. The use of drip irrigation by one or more of the proposed mines would substantially reduce irrigation water requirements, since these systems, as reported by DeRemer and Bach (Thames ed. 1977), use from 5% to 40% of the water used by other irrigation systems.

23. The mining companies, prior to receiving a permit to mine in the state of Wyoming, would be required to revise proposed seeding mixtures to incorporate recommendations by state and federal agencies, including the Wyoming Game and Fish Department (see site specifics, Chapter 3, Guidelines, in regard to seed mixture revision). Site specific alternatives have been identified and are included in the final ES wherein the mine and reclamation plans would be conditionally approved subject to successful demonstration of reclaimability. Additionally, see response number 2.

24. See response numbers 2 and 23.

25. Text revised (site specifics, Chapters 2, 3, and 4, Water Resources). The mining companies would be required to obtain adequate data to allow the

development of standards. The implementation of measures to meet developed standards would result in the protection of water and associated resources from adverse impacts.

Although fish population data are available, a method to determine loss of fish due to sedimentation was not available; therefore, no quantification was attempted anywhere other than in the North Block site-specific ES. The North Block fishery section, Chapter 3, was revised and quantification eliminated in the final ES.

26. Streams were not converted to acreage and added to land acreage.

27. Text revised (Regional, Chapter 4, Fish and Wildlife, Summary of the Fish and Wildlife Population Losses).

28. Text revised (Regional and site specifics, all Fish and Wildlife sections).

29. Text revised (Regional, Chapter 4, Fish and Wildlife, discussion of carrying capacity).

30. Deer and unfenced antelope may be observed in the region grazing on seeded grass species along highway rights-of-ways and browsing on shrub species such as rabbitbrush and saltbush (present through natural plant succession). Such occurrences seem to contradict the broad statement concerning a lack of successful reclamation anywhere in the region. See the revised Vegetation sections, Chapter 3s, site specifics, concerning reclamation.

31. Text revised (Regional, Chapters 2 and 4, Fish and Wildlife, all pertinent sections).

32. Text revised (Regional, Chapter 4, Fish and Wildlife, discussion of nongame mammals).

33. The "primitive" quality recreation impact can be both short- and long-term. (1) The increased number of people recreating in the area will be detrimental to the primitive quality in the short-term and (2) the damage these people do to the natural environment can be detrimental to the primitive quality of recreational experience in the long-term. Please refer to Reclamation and Use of Disturbed Land in the Southwest Thames, Part IV, Mining and the Amenities; Chapter 18, Recreational Opportunity Cost, Importance of Opportunity Cost, and Recreational Resources and their Utilization, pp 169-172.

34. The Fish and Wildlife Mitigation Alternative, if selected, would be coordinated with the Wyoming Game and Fish Department, the BLM, and the U.S. Fish and Wildlife Service to alleviate the concerns raised in the comment.

35. Text revised (North Block, Chapter 3, Fish and Wildlife, discussion of fisheries). Also, see response number 25.

36. Text revised (North Block, Chapters 2 and 3, Fish and Wildlife, discussion of fisheries).

37. The data from Wyoming Game and Fish Department contract information did not indicate the presence or absence of raptors or prairie dogs on the North Block project area. The confusion could have arisen because of mine permit boundary discrepancies when the contract was written.

38. See response numbers 7, 8, 22, 23, and 30.

39. Grass species have primarily been seeded. Ocular reconnaissance indicates that the forage production on such reclaimed areas would compare quite favorably with adjacent undisturbed sites. The Wyoming Highway Department does commonly employ fairway crested wheatgrass (Agropyroa cristatum) in seed mixtures along state highway rights-of-way. Of interest in regard to highway rights-of-way reclamation is that research is needed to select plant species less seasonally palatable than species such as crested wheatgrass, in an attempt to decrease livestock and wildlife vehicle collisions.

40. The North Block, Chapter 1, Reclamation section, presents reclamation methods and procedures and proposed seeding mixtures.

41. Text revised (North Block, Chapter 3, Fish and Wildlife, discussion of fisheries).

42. Text revised (North Block, Chapter 4).

43. The first sentence implies that restoration would be possible. According to the National Academy of Sciences 1974 report Rehabilitation Potential of Western Coal Lands, "restoration" implies that the conditions of the site at the time of disturbance will be replicated after the action. Reclamation authorities consider restoration to be rarely possible. Primarily native plant species would be seeded and (or) planted on lands proposed for mining.

44. Text revised (Twin Creek, Chapter 1, Predisturbance Inventories and Analyses).

45. Text revised (Twin Creek, Chapter 4, Seed Mixture and Methodology Mitigating Measure). Also, see response number 22.

46. See response number 45.

47. Text revised (South Haystack, Chapter 4, Seed Mixture and Methodology Mitigating Measure). Also, see response number 23.

48. Text revised (South Haystack, Chapter 2, Fish and Wildlife, discussion of mammal game species).

49. Acreage disturbance to vegetation types at the proposed mines would differ as presented in the site specifics, Chapter 3s, Vegetation sections. Other parts of the sections are more general, because the climate, soils, likely reclamation problems, and other factors would be highly similar.

50. This data was obtained from BLM files, Rock Springs District Office.

51. A comparison of the vegetation impacts as a result of the proposed Twin Creek, North Block, and South Haystack Mines will reveal differences among these sections in regard to acreages disturbed and disturbance to vegetation types. All three sites are within the ES region and would involve surface mining. The general climatic and soil limitations to reclamation would be for all practical purposes identical.

52. Text revised (site specifics, Chapter 4, Seeding Mixture and Methodology Mitigating Measure, and Chapter 8, Reclamation Alternatives).

53. Text revised (Long Canyon, Chapter 4, Seed Mixture and Methodology Mitigating Measure). Also, see response number 23.

54. Text revised (Long Canyon, Chapter 2, Fish and Wildlife, discussion of endangered and (or) threatened species).

55. The major impact to vegetation due to the proposed mining would be the removal of this resource for varying periods of time. The acreages on which the vegetation would be removed vary from site to site as do the acreages occupied by different vegetation types (see the Vegetation section of the Chapter 3s for more detailed analysis than is presented in the Chapter 5s). The removal of native vegetation would impact many other resources, and of course such resources do vary from one site to another (see sections other than vegetation in the Chapter 3s and 5s).

56. See response number 25.

57. Based on the proposed Black Butte seeding mixtures presented in the revised Black Butte mining and reclamation plan (see Black Butte, Chapter 1, History and Background) used for impact analyses, the reclaimed lands would have a general appearance of grassland, with grasses being the most common forage class. Shrubs, however, would be present on reclaimed land but most likely not in sufficient density to result in initially reclaimed land having the appearance of shrubland.

58. It is felt that the mining operations would draw some people to the area to view the mining, although not in significant numbers.

59. Map revised (Regional, Appendix A, Wildlife Maps).

52

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
WASHINGTON, D.C. 20240

30 JUN 1978

Memorandum

To: Director, Bureau of Land Management

Through: Assistant Secretary, Land and Water Resources

Through: Assistant Secretary, Energy and Minerals Hal Babcock

From: Director, Office of Surface Mining

Subject: Review of Draft EIS on the Development of Coal Resources in Southwestern Wyoming

The Office of Surface Mining (OSM) has reviewed the draft environmental statement (EIS) on the Development of Coal Resources in Southwestern Wyoming and finds the analysis of the five proposed site-specific mining and reclamation plans inadequate. Several concerns relative to the plans follow and these should be addressed in the revision of the draft EIS.

1

° Mining plans included in the EIS are not the same proposals that have been received by the State for review and have subsequently been provided to the Department of the Interior. Even though the permit or lease areas may remain constant, it is important that the mine plans be current if the EIS is to serve as a specific document rather than an area-wide document.

2

° State evaluation of these mine plans has resulted in substantial changes in mining approaches, potential environmental impacts, and mitigation measures. Attached is a summary table indicating the status of each mine plan. It is not clear whether the draft EIS analyzes the changes required by the State.

3

° The timing and sequence of mine operations, along with employment, production, and transportation activities set forth in the EIS, do not reflect operator's present or future plans. As a result, alternative levels of coal production and impacts set forth in the EIS may not describe the most probable conditions, even though the boundaries of impact relative to the high and low estimates may still be appropriate. At a minimum, the EIS serves as a "worst-case" analysis for the 5 site-specific mine plans in that any changes in these mine plans as a result of the application of the re-requirements of SMCRA will serve to mitigate further their environmental impacts.

6/30 5:30 PM

4 ° The provisions of the Surface Mining and Reclamation Act (SMCRA) apply to the existing and proposed coal mining operations analyzed in the EIS. Under either a permanent State regulatory program or a Federal lands program, the requirements of the Act will apply from the outset to some of the new operations due to the dates when mining will begin or permits will be approved. These provisions along with any others that States may require which are "more stringent" replace current environmental protection standards. The analysis of site-specific impacts in the EIS should be revised to reflect the current standards required by SMCRA.

5 ° Information in the EIS pertaining to revegetation capabilities and potentials at the proposed mine sites is insufficient with respect to requirements of SMCRA and OSM's interim regulations (30 CFR 700 et. seq.).

6 ° Statements in the draft EIS no not reflect Wyoming's basic reclamation requirements nor the requirements of SMCRA. For example, the discussion of "geologic hazards" includes residual fires in outcrops of coal remaining in highwalls after reclamation is completed (pg. R4-10). Neither Wyoming's program nor SMCRA would allow exposed outcrops of coal to remain and require that all highwalls be completely backfilled.

7 ° The negative determination that no "alluvial valley floors" are present at the selected minesites should be re-evaluated.

8 ° The analysis of impacts of proposed mining on the hydrologic balance of the specific sites, as well as cumulative impacts throughout the entire area, is inadequately documented. Water quality impacts of the proposed post-mining impoundments require additional data and analysis. This inadequacy has been one of the significant factors in the withdrawal of some proposals submitted to the State. The revised analyses should include the differences and implications arising from alternative regrading and hydrologic re-establishment schemes proposed for the Black Butte mine site.

9 ° The EIS incorrectly assumes that several of the proposed mines will qualify as special bituminous coal mines under Section 527 of SMCRA. The provisions of Section 527 do not set aside prior administrative findngs or decisions by the State.

Despite the uncertain status of these five site-specific plans, the regional impacts of coal development and related mitigating measures could be analyzed separately or as presented in this EIS. However, because of national energy needs, OSM recommends that the final EIS be expeditiously completed. As State-approved final mining and reclamation plans for each of the five mines are received, OSM will prepare an environmental analysis of the significant differences between the environmental impacts of the plans as described in this EIS and the final plans submitted to the State.

OSM hopes that these comments prove helpful in the revision of the draft statement. My staff is available for discussion of our comments at your convenience.

Attachment

STATUS OF THE 5 NEW MINES IN S.W. WYOMING EIS

Mine	1/ Mine Plan Submitted To DEQ	2/ Status with State DEQ	Comments
Black Butte	1977	Permit Approved	Permit approval being modified to assure compliance with the Federal Surface Mining Act. Alternative reclamation of surface hydrology dependent upon water quality findings.
North Block	1975	Plan Withdrawn	Considerable changes in mine plan design and environmental protection anticipated. No near-term action required. Possible mid to late 1979 re-submission.
Twin Creek	1977	Plan Withdrawn in 1977	Mine plan under substantial revision concerning regrading and surface hydrology. Possible re-submission in late 1978. Joint reclamation with adjacent operations under consideration.
Long Canyon	1977	No Plan Submitted	No explicit interest or contact with State.
South Hay-stack	1977	Initial Plan Found Incomplete	Additional baseline data being collected. Possible re-submission to State in first 6 months of 1979. Early action not anticipated.

1/ Source: Pg. R1-3, Draft EIS

2/ Source: Discussions with Department of Environmental Quality, State of Wyoming, June, 1978.

R9-255

52

Letter 52 Responses

1. It is recognized that the mining and reclamation plans may not be the latest revised plans prepared by the mining companies. In order to continue the preparation of the ES without continual changes, a cutoff date was established beyond which revisions and changes in the mining and reclamation plans were not accepted for inclusion into the ES. The Surface Mining Control and Reclamation Act (SMCRA) sections, Chapter 1 were provided to the ES team by the Office of Surface Mining. These sections explain that the mining and reclamation plans will be returned to the applicant for modification to incorporate the requirements of SMCRA. Since the worst case is covered in the ES, the revised plans are expected to reduce the identified impacts.

2. See response number 1, The State-required changes were not analyzed in the final ES, since revisions to comply with SMCRA may also change plans on file with the State.

3. The data used concerning the mine operations, employment, production, and transportation are those provided the ES team or were derived from data provided the ES team by the USGS. While the ES serves as a worst-case analysis of the mining and reclamation plans, the timeliness of the initial regulation, 30 CFR 700, and subsequent intrepretation was such that inclusion of analysis into this ES was precluded.

4. The mining and reclamation plans are being returned to the applicants for modification to include the provisions of SMCRA. Once the revised plans are resubmitted by the applicants, they will be reviewed by USGS and the Office of Surface Mining for compliance with SMCRA. At that time any additional need for environmental analysis or supplemental environmental statements will be determined (see site specifics, Chapter 1, SMCRA section).

5. Additional information pertaining to revegetation capabilities will be forthcoming when the mining and reclamation plans are returned to the applicant for revisions to include the provisions of SMCRA and then resubmitted by the applicant for further consideration by the USGS and the Office of Surface Mining.

6. Text revised (Regional, Chapter 4, Geologic Hazards).

7. Text revised, see discussion of alluvial valley floors in each site specific and Regional as appropriate.

8. Additional documentation concerning hydrologic balance will be provided when the mining and reclamation plans are returned to the applicant for modification to include the provisions of SMCRA, and the subsequent modified mining and reclamation plans are submitted to the USGS and the Office of Surface Mining for further consideration.

9. Section 527 of SMCRA is currently under legal review by the Department of Interior. Until this legal review is completed, approval of those mining and reclamation plans which may or may not qualify will be withheld.

THE FOLLOWING LETTERS WERE RECIEVED

TOO LATE TO RESPOND TO EITHER IN THIS

CHAPTER OR IN THE TEXT.

53

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

Routing 7/27/78 Initial & Date
SD
RS 7/31
CY
Lead Resp. D

July 24, 1978

Mr. Daniel P. Baker
State Director
State Office
Bureau of Land Management
P. O. Box 1828
Cheyenne, Wyoming 82001

Dear Mr. Baker:

On June 22, 1978, the Council received a determination from the Bureau of Land Management that approval of coal strip mining and related facilities at the Black Butte Mine, Sweetwater County, Wyoming, would not adversely affect the Hallville Mine and Townsite, the Gibralter Mine and Townsite, or the Black Buttes Stage Station, properties determined on the authority of the Secretary of the Interior to be eligible for inclusion in the National Register of Historic Places. The Executive Director does not object to your determination.

A copy of your determination of no adverse effect, along with supporting documentation and this concurrence, should be included in any assessment or statement prepared for this undertaking in compliance with the National Environmental Policy Act and should be kept in your records as evidence of your compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f, as amended, 90 Stat. 1320).

Your continued cooperation is appreciated.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

54

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

Routing 7/27/78 Initial & Date

1 PGT

2 CY

CF

Lead Resp. 2

July 21, 1978

Mr. Daniel P. Baker
State Director
State Office
Bureau of Land Management
P. O. Box 1828
Cheyenne, Wyoming 82001

Dear Mr. Baker:

On June 22, 1978, the Council received a determination from the Bureau of Land Management that approval of coal strip mining and related facilities at the South Haystack Mine, Lincoln County, Wyoming, would not adversely affect the Cumberland Townsite, a property determined on the authority of the Secretary of the Interior to be eligible for inclusion in the National Register of Historic Places. The Executive Director does not object to your determination.

A copy of your determination of no adverse effect, along with supporting documentation and this concurrence, should be included in any assessment or statement prepared for this undertaking in compliance with the National Environmental Policy Act and should be kept in your records as evidence of your compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f, as amended, 90 Stat. 1320).

Your continued cooperation is appreciated.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

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55

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

Routing 7/21/78 Initial & Date

Lead Resp.

July 21, 1978

Mr. Daniel P. Baker
State Director
State Office
Bureau of Land Management
P. O. Box 1828
Cheyenne, Wyoming 82001

Dear Mr. Baker:

On June 22, 1978, the Council received a determination from the Bureau of Land Management that approval of coal mining and related facilities at the Long Canyon Mine, Sweetwater County, Wyoming, would not adversely affect the Cedar Canyon Petroglyphs and site, a property determined on the authority of the Secretary of the Interior to be eligible for inclusion in the National Register of Historic Places. The Executive Director does not object to your determination.

A copy of your determination of no adverse effect, along with supporting documentation and this concurrence, should be included in any assessment or statement prepared for this undertaking in compliance with the National Environmental Policy Act and should be kept in your records as evidence of your compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f, as amended, 90 Stat. 1320).

Your continued cooperation is appreciated.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

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APPENDIX B

AIR QUALITY IMPACTS

Emissions from Coal Mining

Existing pollutant concentrations such as total suspended particulates (TSP), sulfer dioxide (SO_2), nitrogen dioxide (NO_2), hydrocarbons (HC), and carbon monoxide (CO) would be affected by development of the proposed actions. Coal mining, in general, is a significant source of particulate emissions, but its impact on SO_2, NO_2, HC, and CO is relatively small. To determine the change in TSP concentrations caused by the most probable level of mining development in southwestern Wyoming, it is necessary to estimate the quantity of TSP emitted into the atmosphere. Many of the operations associated with coal mining constitute significant sources of fugitive dust that, in turn, contribute to elevated ambient particulate levels in the vicinity of the mine. Activities analyzed in this environmental statement (ES) are enumerated below:

1. overburden removal and handling associated with interim storage at spoils dumps;
2. removal of coal from seam and truck loading;
3. truck dumping of coal;
4. crushing and screening;
5. coal transfer operations;
6. haul-road and access-road traffic and maintenance operations;
7. wind erosion from disturbed and exposed land;
8. reclamation operations; and
9. wind erosion from aggregate storate of coal.

It is evident that some of these activities overlap. For example, overburden removal and storage necessarily involve truck dumping and wind erosion from spoils dumps.

In general, the emission factors used in the current investigation for the various mining activities were obtained from the Environmental Protection Agency (EPA) document (1977) and the PEDCo (1976) report. The factors presented in these reports were, for the most part, taken directly from several previous studies. It is important to note that the reliability of these emissions factors, in general, has been rated "poor"by the EPA (1977). Such factors are qualified as supportable by best engineering judgment, involving visual observation and judgmental adjustments to results of emission tests conducted at noncoal mining sources. It is evident, therefore, that errors and inconsistencies may arise from two sources. The first of these is represented by dissimilarities between the prototype coal mine (not accounted for in the adjustments) on which the EPA factor is based and the nonmining activities where the sampling occurred. The second is the potential dissimilarity between the prototype coal mine and the ES region mines. The geological and soil characteristics, as well as the modes of operation at these sites, may bear little resemblance to the proposed mines in the ES region that were analyzed.

Contributions to the annual particulate emissions burden from the various fugitive dust sources at each of the five proposed mines and two private projected mines are given in Tables RB-2A, RB-2B, and RB-2C. Although these emission rates are given as yearly averages, all activities are not continuous. As such, they are approximations of the complex interaction of variables that affect pollutant emissions. From the tables, the following observations are apparent:

1. In general, wind erosion from unreclaimed land constitutes the most significant single source of fugitive dust from the surface mines, accounting for 20% to 50% of the total. These figures, however, are based on the assumption that planting would begin in the fall, that surface roughness and sheltering effects are negligible, and that mulching and planting are performed in a onestep operation.

2. Overburden removal and storage operations appear to be the most important sources of emissions except for wind erosion, accounting for about 25% to 40% of total fugitive emissions. Overburden removal constitutes 68% of the total emissions for Black Butte in the final year of coal mining because of the inordinately large amount of overburden material (200 million tons) that must be displaced.

3. Emissions from haul and access road traffic at the surface mines range from 10% of the total at Twin Creek and Black Butte to about 30% at South Haystack for those years when overburden haulage would be occurring. Unpaved road emissions would only be about 3% of the total for both South Haystack and Twin Creek during those years when overburden would not be hauled.

4. Emissions from coal handling and storage account for only about 2% of the total fugitive emissions at the surface mines and 10% to 15% of the total for the underground mines.

5. Because overburden removal and truck haulage is not involved in the underground mines, wind erosion, coal handling, and access roads are predicted to account for a significantly higher percentage of the total emissions at these mines compared with the surface mines. Fugitive emissions from underground mines, however,

Table RB-2A

1980 PARTICULATE EMISSIONS FROM COAL MINES IN ES REGION
(tons per year)

	North Block	Twin Creek	South Haystack	Black Butte	Long Canyon	Winton[1]	Reliance[1]	Total
Overburden removal	-	648	382	1,121	NA			2,151
Ore loading	-	125	75	270	25			495
Truck dumping	-	25	15	54	5			99
Train loading	NA	2	2	5	0			10
Conveying	-	12	8	27	2			50
Coal storage	NA	1	0	2	3			6
Crushing (primary)	-	1	1	3	0			5
Crushing (secondary)	-	4	2	9	NA			15
Overburden dump disturbance	-	255	240	NA	NA			495
Employee access roads	33	1	38	43	70			186
Haul roads (coal)	-	106	16	357	NA			478
Haul roads (overburden)	-	359	570	NA	NA			929
Haul road repair	-	56	56	56	NA			168
Dozers (overburden dumps	56[2]	81	56	224	NA			417
Wind erosion	245	729	624	1,020	135			2,753
Total	334	2,405	2,084	3,190	242			8,256

[1]These mines are not operational in 1980. They are private, projected mines and are not part of the proposed actions.

[2]Associated with initial construction activities.

- Particular operation not active in 1980.

NA = Not Available

Table RB-2B

1985 PARTICULATE EMISSIONS FROM COAL MINES IN ES REGION
(tons per year)

	North Block	Twin Creek	South Haystack	Black Butte	Long Canyon	Winton[1]	Reliance[1]	Total
Overburden removal	133	648	763	1,435	NA	NA	NA	2,979
Ore loading	70	125	150	330	100	100	25	900
Truck dumping	14	25	30	66	20	20	5	180
Train loading	NA	2.5	3.0	6.6	2	2	0.5	16.6
Conveying	7	12.5	15	33	10	10	2.5	90
Coal storage	NA	0.7	0.8	1.8	13.5	0.5	0.1	17.4
Crushing (primary)	0.7	1.2	1.5	3.3	1.0	1.0	0.2	8.9
Crushing (secondary)	5.6	4	4.8	10.6	NA	NA	NA	25
Overburden dump disturbance	50	180	-	NA	NA	NA	NA	230
Employee access roads	132	1.1	32	37	125	35	8.7	371
Haul roads (coal)	158	105	31	437	NA	NA	NA	731
Haul roads (overburden)	40	222	-	NA	NA	NA	NA	262
Haul road repair	56	56	56	56	NA	NA	NA	224
Dozers (overburden dumps)	56	81	56	224	NA	NA	NA	417
Wind erosion	299	1,702	453	2,111	135	36	36	4,772
Total	1,021	3,166	1,596	4,751	406	204	78	11,223

[1]Considered only in the cumulative impact analysis. These mines are private, projected mines and are not part of the proposed actions.

- Particular operation not active in 1985.

NA = Not Available

Table RB-2C

1990 PARTICULATE EMISSIONS FROM COAL MINES IN ES REGION
(tons per year)

	North Block	Twin Creek	South Haystack	Black Butte	Long Canyon	Winton[1]	Reliance[1]	Total
Overburden removal	133	648	763	960	NA	NA	NA	2,504
Ore loading	70	125	150	315	100	100	25	885
Truck dumping	14	25	30	63	20	20	5	177
Train loading	NA	2.5	3.0	6.3	2	2	0.5	16.3
Conveying	7	12.5	15	31.5	10	10	2.5	88.5
Coal storage	NA	0.7	0.8	1.7	13.5	0.5	0.1	17.3
Crushing (primary)	0.7	1.2	1.5	3.2	1.0	1.0	0.2	8.8
Crushing (secondary)	5.6	4	4.8	10.1	NA	NA	NA	21.2
Overburden dump disturbance	-	-	-	NA	NA	NA	NA	-
Employee access roads	132	1.1	32	37	125	34.8	8.7	370.9
Haul roads (coal)	157.5	158	31	417	NA	NA	NA	763.5
Haul roads (overburden)	-	-	-	NA	NA	NA	NA	-
Haul road repair	56	56	56	56	NA	NA	NA	224
Dozers (overburden dumps)	56	80.6	56	224	NA	NA	NA	416.6
Wind erosion	298	1,434	550	1,861	135	36	36	4,350
Total	930	2,549	1,693	3,986	406	204	78	9,843

[1]Considered only in the cumulative impact analysis. These mines are private, projected mines and are not part of the proposed action.

- Particular operation not active in 1990.

NA means not available.

are typically an order of magnitude (or more) lower than surface mine emissions.

Where input data were not available, it was assumed that routine practices at existing surface and underground mines would be employed, except that recently enacted Wyoming regulations for dust control would be implemented as part of the proposed actions.

In general, an attempt was made to take a conservative, realistic, approach in the emissions analysis. Consequently, while it is not possible to guarantee that none of the results underestimate the actual situation, the likelihood of overprediction from the composite of all mining activities at a given mine should be higher that that of underprediction.

No attempt has been made in this investigation to evaluate the potential uncertainties inherent in the mining plans, although these uncertainties are recognized in those instances where the ultimate impact on annual emissions would be significant.

Because of the serious limitations inherent in state-of-the-art emission factors, the fugitive emissions burdens estimated for proposed and projected coal mines in the southwestern Wyoming ES region, along with subsequently derived particulate concentrations, are deemed to be questionable in assessing absolute impact in terms of compliance with existing air quality standards. The quantitative results should, therefore, be viewed as a device to be used in a comparative assessment of impact among different coal mines, scenarios, or subregions and for clues as to the appropriate prioritization of mitigating measures.

Modeling Techniques

The Environmental Research and Technology (ERT) air quality model (ERTAQ) was used to model long-term impact of all emissions shown on Tables RB-2A, RB-2B, RB-2C. A description of ERTAQ and its relation to diffusion modeling is discussed in the Chapter 4, Regional Technical Report (ERT 1978a), available at the Rock Springs District Office of the BLM. The emissions from the various sources at each mine were added to represent a single source originating across the entire mining area. For analytical purposes, each mine was modeled as an area source. Because of the wide variations in individual emission point characteristics during mining operations, the size of each area source was equated to the area of disturbed acreage. For the calculation of annual average concentrations, disturbed acreage is defined as that portion of land where ongoing mining operations are active in combination with previously mined, unreclaimed acreage. Table RB-2D depicts the disturbed acreage used in the annual average simulations for each mine. For 24-hour average calculations, it is assumed that disturbed acreage on any one day would not exceed 25 acres. This is a realistic representation considering the wide variations in individual emission points during mining operations. Therefore, the size of each area source for all mines associated with disturbed acreage greater than 25 for the annual average analysis was reduced for modeling 24-hour averages.

To evaluate the numerical results of the modeling analysis, it is important to denote the uncertainties associated with the modeling of fugitive dust from coal mines. Although the ERTAQ model and its application herein is considered state-of-the-art technology, inherent assumptions need to be stressed.

When evaluating isopleths depicting annual and 24-hour average impact resulting from the most probable level of mining development, the reader must realize that the absolute value of the numbers associated with the impacts were derived from analysis techniques involving a large number of uncertainties. The important points to note are the relative contributions from the individual mines to simulated suspended particulate (SP) concentrations, as well as the relative distribution of predicted SP levels indicative of the interaction of the individual mines with one another under specific meteorological conditions. In this sense, if all the uncertainties have the same effect on each mine, the absolute values associated with the isopleths presented in Chapter 4, Regional, change, but the predicted distribution and the contribution from each mine to simulated SP levels would not. In this manner, as the state-of-the-art technology for evaluating fugitive dust emissions improves, the value of this analysis as a guideline to evaluate relative impact from the most probable level of mining development will not change.

A number of modeling assumptions were necessary to expeditiously complete this impact analysis:

1. The meteorological data taken at Rock Springs and Fort Bridger are assumed to be similar to that at the proposed action mines for annual and 24-hour worst-case metorological conditions.

2. The model simulations assume the effluents rate to be constant to represent steady state conditions.

3. The mines were modeled as area sources; the size of each area source was equated to the disturbed acreage calculated for each analysis year. Therefore, emission rates incorporating all types of mining activities were uniformly distributed across a single area source.

4. Because of time constraints, lack of data, and model limitations, the effect of topography on local diffusion characteristics was not considered in this analysis.

5. Deposition, although somewhat inherent in the derivation of emission factors, is not included in the ERTAQ model due to lack of source specific information on particle characteristics. If deposition was included in the modeling of fugitive emissions, concentrations predicted during light wind speed conditions could be reduced substantially. The effect of deposition at higher wind speeds is much less because the wind energy is able to carry large particles further. However, at the present time, theoretical equations characterizing deposition of fugitive dust from coal mines have not been adequately validated.

6. An initial mixing volume of 30 feet for area sources of mine operations is assumed. This feature allows the pollutant to form "puffs"of the specified depth before dispersing downwind.

Detailed discussion of each of these assumptions can be found in the Chapter 4, Regional Technical Report (ERT 1978a), on file at the Rock Springs District Office of the BLM.

Table RB-2D

ACRES DISTURBED EQUALS SIZE OF AREA SOURCE IN ERTAQ MODELING

	1980	1985	1990
Long Canyon	542	542	542
Black Butte	1,399	3,303	2,996
North Block	216	316	311
South Haystack	743	566	671
Twin Creek	643	1,536	1,423
Winton[1]		140	140
Reliance[1]		90	90

[1]Considered only in the cumulative impact analysis. These are private, projected mines, and are not part of the proposed actions.

SOILS

Legend—Southwest Coal Region Soils Map

1. Soils of Residual Uplands; Elevation 6,000-7,000; Precipitation 5-9 inches.

1A. Shallow, loamy, alkali association. Primarily consists of nearly level to steeply sloping, shallow, loamy soils on shales in association with nearly level to sloping, moderately deep and deep, loamy and clayer soils on alluvial fans and bottomlands. Most of these soils are derived from the saline alkaline shales of the Bridger, Green River, and Wasatch Formations and, as a result, are saline and alkaline. Scattered areas of badlands, sand dunes, and playas also occur in this *association.*

Subgroup
Typic Torriorthents
Typic Calciorthids
Typic Torripsamments
Typic Natrargids

1B. Shallow, loamy and clayey, alkali association. Primarily consists of gently sloping to steep, shallow, loamy, and clayey soils on saline-alkaline Cretaceous shales. Small areas of moderately deep soils and areas of deep soils occur throughout the mapping unit. Extinct volcanoes (North Table and South Table Mountains) occur in this mapping *unit.*

Subgroup
Typic Torriorthents
Typic Calciorthids
Lithic Torriorthents
Typic Torrifluvents
Typic Natrargids

1C. Playas—Basins land association. Primarily consists of nearly level to strongly sloping, moderately deep to deep, saline-alkali clayey and loamy soils that have formed in old lakebeds and outwash areas. Scattered sand dunes occur in this *association.*

Subgroup
Typic Calciorthids
Typic Torriorthents
Typic Torripsamments
Typic Torrifluvents
Typic Natrargids

1D. Active sand dunes land type. Consists of gently sloping to choppy, rolling sand dunes derived from Tertiary sandstones and shales. Scattered badlands and alkali playas occur among the sand *dunes.*

Subgroup
Typic Torripsamments
Typic Torriorthents

1E. Shallow, loamy association. Consists of predominantly rolling to moderately steep; shallow, loamy soils mixed in association with moderately deep and deep, loamy soils on shales and sandstones of the Wasatch and Green River *Formation.*

Subgroup
Typic Torriorthents
Typic Calciorthids
Lithic Torriorthents
Typic Torrifluvents

1F. Shallow-Rockland association. Consists of moderate to steeply sloping; shallow and very shallow; sandy and clayey soils in complex with rockland of exposed sandstone of Frontier Formation and uplifted saline marine shales of Hilliard *Formation.*

Subgroup
Lithic Torriorthents
Typic Calciorthids
Typic Torriorthents
Typic Torrifluvents
Borollic Camborthids

1G. Fine, saline association. Consists of undulating to rolling, shallow and moderately deep, saline clayey soils underlain by saline marine shales of *Cretaceous age.*

Subgroup
Typic Torriorthents
Typic Calciorthids
Lithic Torriorthents
Borollic Haplargids

2. Soils of Residual Uplands; Elevation 7,000-8,000 feet; Precipitation 10 to 14 inches.

2A. Loamy, shallow association. Primarily consists of nearly level to steeply sloping, shallow, loamy soils on high dissected plateaus of Green River, Bridger, and Wasatch Formations. Scattered areas of moderately deep soils and deep soils occur throughout the mapping unit. Saline-alkali soils, badlands, and sand dunes also occur in the mapping *unit.*

Subgroup
Ustic Torriorthents
Borollic Haplargids
Borollic Calciorthids
Argic Cryoborolls
Mollic Cryoboralfs

2B. Shallow, loamy—Rockland association. Consists of moderate to steeply sloping, shallow and very shallow, clayey soils in complex with rockland of exposed, steeply uplifted saline marine shales of Cretaceous *age.*

Subgroup
Ustic Torriorthents
Borollic Calciorthids
Borollic Haplargids

2C. Shallow, lithic, loamy association. Predominantly consists of shallow and very shallow, loamy soils underlain by moderate to steeply sloping uplifted bedrocks of limestone, siltstone, and *sandstone.*

Subgroup
Typic Cryorthents
Typic Cryoborolls
Lithic Xeric Torriorthents

2D. Shallow, loamy—Rock Escarpments association. Primarily consists of nearly level to steeply sloping, shallow, sandy and loamy soils on saline-alkaline cretaceous shales and vertical rock escarpments, small areas of moderately deep soils and deep soils occur throughout the mapping *unit.*

Subgroup
Ustic Torriorthents
Borollic Calciorthids
Lithic Torriorthents

Typic Torriorthents
Typic Calciorthids

2E. Loamy-skeletal association. Consists of well drained, moderately deep, dark colored loamy soils over gravel and cobble in complex with excessively drained, very cobbly, and stony soils on gently sloping high *benchlands.*

Subgroups
Ustic Torriorthents
Borollic Calciorthids
Borollic Haplargids
Argic Cryoborolls

2F. Loamy—skeletal, poorly drained association. Consists of mostly deep, dark loamy soils with some very cobbly and stony soils occupying gently sloping, high, and intermediate benchlands. These soils are poorly or somewhat poorly drained in wet, irrigated *meadows.*

Subgroup
Typic Cryoborolls
Ustic Flavaquents
Typic Cryaquents
Argic Cryoborolls
Typic Cryaquepts

3. Soils of Mountains, High Plateaus, and Uplands; Elevation 7,000-10,000 feet; precipitation 10-19 inches.

3A. Shallow, loamy—deep gravelly association. Consists of gently sloping to steep, rough broken foothills and mountains. The mapping unit contains both shallow, loamy, residual soils on saline-alkaline shales and deep, gravelly, alluvial fan soils. Within the mapping unit are Aspen-Little-Tepee-Pine-Cedar Mountains and Ramsey *Peak.*

Subgroup
Ustic Torriorthents
Borollic Calciorthids
Borollic Haplargids
Typic Cryoborolls
Typic Cryoboralfs

3B. Coarse-loamy—Skeletal association. Predominantly consists of excessively drained, very cobbly, and very stony loamy soils formed on glacial moraines occupying moderate to moderately steep sloping foothill outwashes from adjacent higher *mountains.*

Subgroup
Typic Cryorthents
Typic Cryoborolls
Argic Cryoborolls

3C. Fine-loamy—Skeletal association. Predominantly consists of deep, loamy, well drained and excessively drained, very gravelly, cobbly, and stony forest soils formed on glacial till and moraines. The mapping unit occupies gently sloping to steep *slopes.*

Subgroups
Typic Cryoborolls
Agric Cryoborolls
Typic Cryoboralfs

3D. Shallow, loamy—Skeletal association. Consists of primarily shallow but some deep loamy and stony forest soils underlain mostly by limestone, siltstone, and sandstone. The mapping unit occupies gently sloping to steep *slopes.*

Subgroup
Typic Cryoborolls
Argic Cryoborolls
Typic Cryoboralfs
Typic Cryorthents

4. Soils of Bottomlands, Low Terraces, and Alluvial Fans along the Major Streams; Elevation 6,000-8,000 feet; Precipitation 5-9 inches.

4A. Loamy, poorly drained association. Consists of predominantly nearly level to gently sloping, poorly or somewhat poorly drained, loamy soils in wet irrigated meadows on bottomlands and low terraces with adjacent gravelly and loamy soils on gently to moderately sloping fans. Some saline-alkali soils also occur in the *association.*

Subgroup
Typic Torrifluvents
Typic Fluvaquents
Typic Halaquepts

4B. Coarse-loamy, poorly drained association (10-14 inches precip.).

This mapping unit consists of Henry's Fork bottomland soils. They are nearly level to gently sloping, moderately well to poorly drained, sandy, loamy, and clayey saline-alkaline floodplain and irrigated wet meadow *soils.*

Subgroup
Ustic Torrifluvents
Typic Fluvaquents
Typic Haplaquolls
Typic Cryaquolls
Typic Halaquepts

4C. Gravelly terrace soils. Consists of nearly level to steeply sloping, shallow, moderately deep and deep, gravelly, sandy, loamy, and clayey soils on low terraces, high terraces, and alluvial fans that mantle saline-alkaline shale of Tertiary Bridger Formation. Scattered areas of badlands, shale buttes, terrace escarpments, and saline-alkaline soils of the Green River and Lower Big Sandy bottomlands occur in this mapping *unit.*

Subgroup
Typic Torrifluvents
Typic Calciorthids
Typic Fluvaquents
Typic Halaquepts
Typic Torripsamments

4D. Fine-loamy, poorly drained association. Consists of poorly and somewhat poorly drained, saline-alkali clayey soils in low-lying bottomlands and adjacent loamy soils on gently to moderately sloping fans and terraces. Also included in the mapping unit are some scattered areas of rolling silty loess *soils.*

Subgroup
Typic Cryaquents
Typic Cryaquolls
Typic Cryofluvents
Borollic Haplargids
Calcic Argixerolls
Xerollic Calciorthids

4E. Loamy and Gravely, poorly drained association. Consists of predominantly nearly level to gently sloping, poorly or somewhat poorly drained saline-alkali, gravelly and cobbly, loamy soils underlain by gravel. They

occupy stream bottoms, low terraces, and wet irrigated meadows. Included in mapping are small areas of shallow loamy and clayey soils underlain by saline-alkaline shales of the Bridger *Formation.*

Subgroup
Typic Calciorthids
Typic Torriorthents
Typic Torripsamments
Typic Fluvaquents
Typic Torrifluvents

Table RB-5A

SOUTHWEST COAL REGION SOILS MAP
INTERPRETATIONS AND LIMITATIONS

Uses	General Soil Areas																					
	1A	1B	1C	1D	1E	1F	1G	2A	2B	2C	2D	2E	2F	3A	3B	3C	3D	4A	4B	4C	4D	4E
Agriculture																						
Irrigated farming	c	c	c	c	c	c	b-c	c	c	c	c	b-c	c	c	c	c	c	b-c	b-c	b-c	b-c	b-c
Range	b-c	b-c	b-c	b-c	b-c	b-c	b-c	b-c	b-c	b-c	b-c	a-c	a-c	a-c	a-b	a-c	b-c	a-b	a-b	a-c	a-c	a-c
Woodland	c	c	c	c	c	c	c	c	c	c	c	b-c	a-b	b-c	a-b	a-b	a-b	c	c	c	c	c
Erosion	b-c	b-c	b-c	c	b-c	b-c	b-c	b-c	b-c	a-c	b-c	a-b	a-b	a-c	b-c	a-c	a-c	a-b	a-b	a-c	a-b	b-c
Recreation																						
Cottage and utility bldg.	b-c	c	b-c	b-c	c	c	b-c	b-c	c	c	b-c	b-c	b-c	b-c	b-c	a-c	b-c	b-c	b-c	a-c	b-c	b-c
Campsites	b-c	c	b-c	c	b-c	c	a-c	b-c	b-c	b-c	b-c	a-b	b-c	b-c	b-c	b-c	a-c	b-c	b-c	a-c	b-c	b-c
Picnic areas	b-c	b-c	b-c	c	b-c	c	b	b-c	b-c	b-c	b-c	a-b	b-c	b-c	b-c	b-c	a-c	b-c	b-c	a-c	b-c	b-c
Intensive play areas	c	c	b-c	c	c	c	b-c	b-c	c	c	b-c	b	c	c	c	c	c	b-c	b-c	a-c	b-c	b-c
Path and trails	b-c	b-c	b-c	b-c	a-c	b-c	b	b-c	b-c	a-c	b-c	a-b	b-c	b-c	b-c	b-c	a-c	b-c	b-c	a-c	b-c	b-c
Golf fairways	c	c	b-c	c	c	c	b-c	b-c	c	c	b-c	b	b	c	c	c	c	b-c	b-c	a-c	b-c	b-c
Urban																						
Residential w/public sewers	b-c	c	b-c	c	c	c	b-c	b-c	c	c	b-c	a-c	b-c	c	c	b-c	a-c	c	c	a-c	c	b-c
Residential w/o pb. sewers	b-c	c	b-c	c	c	c	c	b-c	c	c	b-c	a-c	c	c	c	a-c	b-c	c	c	a-c	c	b-c
Light ind. and commercial	b-c	c	b-c	c	c	c	c	b-c	c	c	b-c	a-c	b-c	c	c	a-c	b-c	c	c	a-c	c	b-c
Highways and streets	b-c	c	b-c	c	c	c	c	b-c	c	c	b-c	a-b	b-c	b-c	b-c	a-c	b-c	c	c	a-c	c	b-c
Source of sand and gravel*	c	c	c	b-c	b-c	c	c	c	c	c	c	b	b	b-c	b	b	c	b-c	b-c	b-c	b-c	b-c

Note: To be used as a guide for generalized resource planning.

a. Slight--relatively free of limitations or limitations are easily overcome.
b. Moderate--limitations must be recognized but can be overcome with good management and careful design.
c. Severe--limitations are difficult or impossible to overcome.

*Source of sand and gravel
a. Good source
b. Fair source
c. Poor source or not present

APPENDIX C

GLOSSARY

ACCELERATED EROSION. Erosion much more rapid than normal, natural, geological erosion; primarily as a result of the influence of the activities of man or, in some cases, animals.

ACID MINE DRAINAGE. Any acid water draining or flowing on, or having drained or flowed off, any area of land affected by mining.

ACID SPOIL. Usually spoil material containing sufficient pyrite so that weathering produces acid water and the pH of the soil determined by standard methods of soil analysis is between 4.0 and 6.9.

ACRE-FOOT. A term used in measuring the volume of water, equal to the quantity required to cover 1 acre 1 foot in depth, or 43,560 cubic feet.

ADIABATIC PROCESS. A thermodynamic change of state of a system on which there is no transfer of heat or mass across the boundaries of that system.

ADVECTION. The process of transport of an atmospheric property solely by the mass motion (velocity field) of the atmosphere. The description of predominantly horizontal large scale motions of the atmosphere.

AEROSOLS. Dispersed solid (or liquid) matter in a gaseous medium. In the context of this report, the only aerosols of interest are suspended particles.

AIR MASS. A widespread body of air that is approximately homogenous in its horizontal and vertical extent, particularly with reference to temperature and moisture distribution.

AIR POLLUTION. The presence of material in the air in sufficient amount and under such circumstances as to interfere significantly with the comfort, health, or welfare of persons, or with full use and enjoyment of property.

ALKALI SOIL. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15% or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

ALKALINITY. The quality or state of being alkaline; the concentration of OH negative ions. According to Water Quality Criteria 1972, EPA.R3.73.033, March 1973, alkalinity is a measure of the capacity of a water to neutralize acids. Anions of weak acids such as bicarbonate, carbonate, hydroxide, sulfide, bisulfide, silicate, and phosphate may contribute to alkalinity.

ALLUVIAL FAN. A sloping, fan-shaped mass of sediment deposited by a stream where it emerges from upland onto a plain.

ALLUVIUM. A general term for all detrital material deposited or in transit by streams, including gravel, sand, silt, clay, and all variations and mixtures of these; unless otherwise noted, alluvium is unconsolidated.

AMBIENT AIR. That portion of the atmosphere, external to buildings, to which the general public has access.

AMBIENT AIR QUALITY. Concentration levels in ambient air for a specified pollutant and a specified averaging time period within a given geographic region.

AMBIENT AIR QUALITY STANDARD. A level of ambient air quality established by federal or state agencies which is to be achieved and maintained; primary standards are those judged necessary, with an adequate margin of safety, to protect the public health; secondary standards are those judged necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

ANGLE OF DIP. The angle an inclined stratum makes with the horizontal.

ANGLE OF REPOSE. The greatest angle to the horizonal that any loose or fragmented solid material will stand without sliding or come to rest when poured or dumped in a pile or on a slope.

ANIMAL UNIT. Considered to be one mature cow with calf or their equivalent based upon an average daily forage consumption of 26 pounds of dry matter per day.

ANIMAL UNIT MONTH (AUM). The amount of feed or forage required by an animal unit for one month.

ANTHROPOGENIC SOURCES. Those associated with man's activities.

ANTICLINE. An elongate fold in the rocks that is convex upward.

ANTICYCLONE. Having a sense of rotation about the local vertical opposite to that of the earth's rotation; i.e., clockwise in the northern hemisphere, counterclockwise in the southern hemisphere, undefined at the equator.

AQUIFER. Any body of rock that is saturated and conducts ground water; any water-bearing formation that yields water to wells or springs.

AQUITARD. A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer; a leaky confining bed. It does not readily yield water to wells or springs but may serve as a storage unit for ground water.

ARTESIAN. An adjective referring to ground water confined under hydrostatic pressure.

ARTESIAN PRESSURE. Hydrostatic pressure of artesian water, often expressed in terms of pounds per square inch at the land surface, or the height to which the water would rise in the well if it were tightly cased.

ARTESIAN SYSTEM. A geologic structure which contains water under hydrostatic pressure.

ARTESIAN WELL. A well in which the water rises above the level at which it was encountered when the well was drilled. Many, but not all, artesian wells flow at the land surface.

ATMOSPHERIC STABILITY. The diffusive capacity of the lower atmosphere. In general, stability may be classified as either stable, neutral, or unstable. With stable conditions, the temperature increases with height and the intensity of turbulence is low because vertical motions are inhibited. Under these conditions, any pollutant emitted at the ground tends to accumulate, while effluents from elevated sources do not normally reach the ground until many kilometers downwind. Conversely, when temperature decreases rapidly with height, the atmosphere is unstable, and the intensity of turbulence is high causing enhanced vertical motion. Low-level emissions are dispersed rapidly upward while high-level emissions are brought rapidly to the ground. As a result, elevated sources frequently make their maximum contributions to very short-term (less than 1 hour) ambient pollutant concentrations with unstable conditions. Between the stable and unstable conditions is the situation in which the temperature decreases adiabatically with height (about $1^{o}C$ per 100 meters). This condition is called neutral stability with near-neutral conditions quite frequent in most locations. For sources with tall stacks the high wind speed neutral conditions supresses plume rise and is often the case in which the highest ground-level concentrations are observed. For ground-level emissions, the concentrations for near-neutral conditions normally are between those for stable and unstable conditions.

AVAILABLE WATER CAPACITY. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

BACKGROUND LEVEL. In air pollution studies, the concentration of a pollutant that would exist in the absence of the particular source under study; a "standard" against which the contribution of the particular source can be compared.

BASIC ELEMENTS. The four major elements (form, line, color, and texture) which determine how the character of a landscape is perceived.

BASIC EMPLOYMENT. Employment engaged in producing goods for export out of the region.

BEDROCK. The solid rock underlying the soil and other unconsolidated materials or appearing at the surface where these are absent.

BENCH. The surface of an excavated area at some point between the bottom of the pit and the original surface of the ground on which equipment can set, move, or operate. A working road or base below a highwall as in contour stripping for coal.

BOUNDARY LAYER. In meterology, a general term for the layer of air adjacent to earth's surface. Several kinds of boundary layers (or the upper limits thereof) can be defined according to different physical or dynamical characteristics.

BROADCASTING. The process of spreading plant seeds on the soil surface by hand or by mechanical means--as opposed to "drilling" seed, which implants the seed under the soil surface.

BROWSE. That part of current leaf and twig growth of shrubs, woody vines, and trees available for animal consumption.

BUOYANCY FLUX. The rate that buoyant force from a source effluent is added to a large volume of air due to density difference between the plume and the ambient air.

CALCAREOUS SOIL. Soil containing sufficient free calcium carbonate or magnesium carbonate to effervesce carbon dioxide visibly when treated with cold 0.1 normal hydrochloric acid.

CALCIC HORIZON. A mineral soil horizon of secondary carbonate enrichment that is more than 15 cm (6 inches) thick, has a calcium carbonate equivalent of more than 15%, and has at least 5% more calcium carbonate equivalent than the underlying C horizon.

CAMBRIAN. The first period of the Paleozoic era, thought to have included the span of time from 570 million years ago to 500 million years ago.

CARBONATE. A mineral compound characterized by a fundamental anionic structure of $CO^{3}\pm$. Calcite and aragonite, $CaCO^{3}$, are examples of carbonates.

CARRYING CAPACITY. The maximum stocking rate possible without inducing damage to vegetation or related resources.

CHARACTERISTIC LANDSCAPE. The established landscape within an area being viewed. This does not necessarily mean a naturalistic character. It could refer to a farming community, an urban landscape, or a primarily natural environment.

CHANNELING. An aerodynamic phenomena of wind flow in a street canyon, river valley, or hilly terrain that causes a persistent directing of wind and pollutants parallel to the street, river, or hills.

CIRCULATION PATTERN. The general geometric configuration of atmospheric circulation at a given time and region.

CLIMATOLOGY. The study of the statistical collection of weather conditions during a specified interval time (usually several decades) at a specified area. The study of the long-term manifestations of weather.

CLOSED BASIN. The depressed topographic feature into which water can run by means of surface drainage, but from which there is no surface outlet.

COAL RESERVE. Coal identified that can be economically and legally extractable at the time of determination.

COAL RESOURCE. Coal in such form that economic extraction is currently or potentially feasible in the future.

COAL SEAM. A layer, vein, or deposit of coal. A stratigraphic part of the earth's surface containing coal.

COLLOIDAL SYSTEM. (Also called colloidal dispersion, colloidal suspension.) An intimate mixture of two substances, one of which, called the dispersed phase (colloid), is uniformly distributed in a finely divided state through the second substance, called the dispersion medium (or dispersing medium). The dispersion medium may be a gas, liquid, or solid and the dispersed phase may also be any of these, with the exception that one does not speak of a colloidal system of one gas in another. A system of liquid or solid particles colloidally dispersed in a gas is called an aerosol.

CONCENTRATION. A measure of the average density of pollutants usually specified in terms of pollutant mass per unit volume of air (typically in units of micrograms per cubic meter), or in terms of relative volume of pollutants per unit volume of air (typically in units of parts per million).

CONDENSATION. The physical process by which a vapor becomes a liquid or solid; the opposite of evaporation. In meteorological usage, this term is applied only to the transformation from vapor to liquid; any process in which a solid forms directly from its vapor is termed sublimation, as is the reverse process.

CONDENSATION NUCLEUS. A particle, either liquid or solid, upon which condensation of water vapor begins in the atmosphere.

CONDUCTANCE (or SPECIFIC CONDUCTANCE). A measure of the ability of water to conduct an electrical current, expressed in micromhos per centimeter at 25°C. Conductance serves as an index to the concentration of dissolved solids in the water. It is often used in conjunction with the sodium-adsorption ratio (SAR) as an indication of the suitability of water for use in irrigation.

CONTRAST RATING. A method of determining the extent of visual impact for an existing or proposed activity that will modify any landscape feature.

CONVECTION. As specified in meteorology, atmospheric motions that are predominantly vertical, resulting in vertical transport and mixing of atmospheric properties.

CONVECTIVE STABILITY. (Also called hydrostatic stability, vertical stability, or convectional stability.) The state of the atmosphere when it is stable relative to vertical displacements. Such an atmosphere tends to remain stratified, in that any air that is displaced vertically is subjected to a buoyant force that tends to restore it to its original level. Convective stability is determined primarily by the temperature lapse rate; an inversion layer is an extreme example of a statically stable layer.

CONVECTIVE TURBULENCE. Turbulence which results when the air is cooler than the ground surface over which it flows.

CRETACEOUS. The final period of the Mesozoic era, thought to have included the span of time from 136 million years ago to 65 million years ago.

CYCLONIC. Having a sense of rotation about the local vertical the same as that of the earth's rotation; that is, as viewed from above, counterclockwise in the Northern Hemisphere, clockwise in the Southern Hemisphere, undefined at the equator.

DEMOGRAPHIC. Characteristics of human populations such as size, growth, density, distribution, and vital statistics.

DEMOGRAPHY. The science of vital statistics, as of births, deaths, marriages, etc., of populations.

DENSITY. The number of individuals per unit area.

DEPOSITION. The laying down of potential rockforming material. The precipitation of dissolved or suspended matter to the bottom of a body of water.

DEVONIAN. A period of the Paleozoic era, thought to have included the span of time from 395 million years ago to 345 million years ago.

DEW POINT (or DEW-POINT TEMPERATURE). The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur. When this temperature is below $0^{o}C$ it is sometimes called the frost point.

DEW POINT SPREAD. (Commonly contracted as spread; also called dew-point deficit, dew-point depression.). The difference in degrees between the air temperature and the dew point.

DIFFUSE SKY RADIATION. (Or skylight; also called diffuse skylight, sky radiation). Radiation reaching the earth's surface after having been scattered from the direct solar beam by molecules or particulates in the atmosphere. Of the total light removed from the direct solar beam by scattering in the atmosphere (approximately 25% of the incident radiation), about two-thirds ultimately reaches the earth as diffuse sky radiation.

DIFFUSION. In meteorology, the exchange of fluid parcels (and hence the transport of conservative properties) between regions in space, in the apparently random motions of a scale too small to be treated by the equations of motion.

DIFFUSIVITY. A measure of the rate of diffusion of a fluid property.

DISPERSION. (1) In air pollution terminology, loosely applied to the removal (by whatever means) of pollutants from the atmosphere over a given area; or, the distribution of a given quantity of pollutant throughout an increasing volume of atmosphere. (2) See colloidal system.

DISSOLVED SOLIDS. A term that expresses the quantity of dissolved material in a sample of water. The term total dissolved solids (TDS) is used to designate the sum of all dissolved constituents.

DISTURBED LAND. Land on which excavation has occurred or upon which overburden has been deposited, or both.

DIURNAL. Daily, especially pertaining to actions or events that are completed within 24 hours or that occur every 24 hours.

DIVIDE. A ridge in the water table or other potentiometric surface from which the ground water represented by that surface moves away in both directions.

DIVIDE (STREAMS). (1) The line of separation, or the ridge, marking the boundary between two adjacent drainage basins or dividing the surface waters that flow naturally in one direction from those that flow in the opposite direction; water parting; height of land; topographic divide; watershed line. (2) A tract of relatively high ground between two streams; a line that follows the summit of an interfluve. (3) The highest summit of a pass or gap. (4) Ground water divide.

DOWNWARPING. The subsidence of the central part of an area relative to its periphery.

DOWNWASH. The transport of pollutants downward to the earth's surface by a descending current of air.

DRAINAGE BASIN. That part of the land surface from which water will drain to a specified stream, lake, or pond.

DRAINAGE WIND. A wind directed down the slope of an incline and caused by greater air density near the slope than at the same level some distance horizontally from the slope (also called gravity wind).

DUAL USE. The use of range by two kinds of livestock within the same growing season.

DUST FALL. The gravitational settling of dust through the atmosphere; also, the dust that has thus settled.

DUST STORM. (Also called duster or black blizzard). An unusual, frequently severe weather condition characterized by strong winds and dust-filled air over an extensive area. Prerequisite to a dust storm is a period of drought over an area of normally arable land, thus providing the very fine particles of dust which distinquished it from the more common sandstorm of desert regions.

ECONOMICS. The science that deals with the productivity, distribution, and consumption of wealth, and with the various related problems of labor, finance, taxation, etc.

EDDY. Any circulation drawing its energy from a flow of much larger scale, and brought about by pressure irregularities as in the lee of a solid obstacle.

EFFECTIVE SOIL DEPTH. The depth of soil material that plant roots can penetrate readily to obtain water and plant nutrients. It is the depth to a layer that differs sufficiently from the overlying material in physical or chemical properties to prevent or seriously retard the growth of roots.

EFFLUENT. The mixture of substances, gases, liquids, and suspended matter, discharged into the atmosphere (or ground, river, ocean) as the result of a given process.

ELECTRICAL CONDUCTIVITY. A value that provides an index to the content of dissolved solids, hence salinity, of water. Used with sodium adsorption ratio to determine the suitability of water for irrigation.

ELEVATED INVERSION. An inversion characterized by its base being displaced above the earth's surface. Elevated inversions can be, for example, initiated by subsidence of air from upper atmospheric levels or are the transitional zones between dissimilar air masses.

EMISSIONS. Effluents into the atmosphere, usually specified in terms of weight per unit time for a given pollutant from a given source.

ENTRAINMENT. In meteorology, the mixing of environmental air into a preexisting organized air current so that the environmental air becomes part of the current.

ENVIRONMENTAL LAPSE RATE. The distribution of temperature in the vertical at a given time and place.

EPHEMERAL STREAM. A stream or reach of a stream that flows only in direct response to precipitation in the immediate locality and whose channel is at all times above the water table.

ESCARPMENT. A steep face or ridge of high land; the escarpment of a mountain range is generally on that side nearest the sea.

EVAPORATION. (See condensation).

EXPOSURE. Direction of slope in respect to points of a compass.

EXTINCTION (Air Quality). The removal of light by absorption and scattering.

FOG. A hydrometeor consisting of a visible aggregate of minute water droplets suspended in the atmosphere near the earth's surface. According to international definition, fog reduces visibility below one kilometer (0.62 miles). Fog differs from cloud only in that the base of fog is at earth's surface while clouds are above the surface. When composed of ice crystals, it is termed ice fog.

FOOTWALL. The wall (bottom of a coal seam, floor) upon which a miner stands.

FORAGE. All browse and herbaceous food that is available to livestock or game animals.

FORMATION. A body of rock large enough to be shown on a geologic map as a practical unit for mapping and having easily recognizable upper and lower boundaries that can be traced in the field.

FREE ATMOSPHERE. (Sometimes called free air.) That portion of the earth's atmosphere, above the planetary boundary layer, in which the earth's surface friction on the air motion is negligible and in which the air is usually treated (dynamically) as an ideal fluid. The base of the free atmosphere is usually taken as the geostrophic wind level.

FRICTION LAYER. Same as planetary boundary layer.

FUMIGATION. The rapid mixing downward to the ground of material that has accumulated aloft during a period of atmospheric stability, an occurance that is common after dawn when the nocturnal temperature inversion is rapidly dissipated by warming due to solar heating of the ground. This condition may also develop in sea breeze circulations during late morning or early afternoon.

GAGING STATION. A particular site on a stream, or reservoir where systematic observations of gage height, discharge, or water quality parameters (or any combination of these) are or have been obtained. Usually equipped with a device to automatically record the gage height of the stream.

GAUSSIAN PLUME EQUATION. The diffusion equation assuming the plume has a normal distribution both in the horizontal and vertical dimensions.

GEOMETRIC STANDARD DEVIATION. The measure of dispersion for a log-normal distribution, the ratio of the 84.13 percentile to the 50th percentile.

GEOSYNCLINE. An elongate area, whose dimensions are measured in scores of miles, in which the crust of the earth was downwarped forming a basin-like structure in which thousands of feet of sedimentary and volcanic rocks accumulated concurrently with its subsidence.

GRAVITY WIND. A wind directed down the slope of an incline and caused by greater air density near the slope than at the same levels some distance horizontally from the slope.

GRAZING. Consumption of range or artificial pasture forage by animals.

GRAZING ALLOTMENT. An area designated for the use of a prescribed number and kind of livestock under one plan of management.

GRAZING CAPACITY. Syn., carrying capacity.

GREENHOUSE EFFECT. The heating effect exerted by the atmosphere upon the earth by virtue of the fact that the atmosphere (mainly its water vapor, carbon dioxide, ozone, and suspended particles) absorbs and reemits radiation that otherwise would escape to space.

GROUND WATER. That part of the subsurface water that is the zone of saturation, supplies water to wells, and provides water that sustains the low flow of perennial streams.

HABITAT. The natural abode of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting life.

HALF SHRUB. A perennial plant with a woody base whose annually produced stems die each year.

HAZE. Fine dust or salt particles dispersed through a portion of the atmosphere The particles are so small that they cannot be felt or individually seen with the naked eye, but they diminish horizontal visibility and give the atmosphere a characteristic opalescent appearance that subdues all colors.

HEAD. The pressure of a fluid above a unit area due to the height at which the surface of the fluid stands above the point where the pressure is determined. Head is often expressed in pounds per square inch or feet of elevation above an arbitrary datum.

HIGH. In meteorology, elliptical for "area of high pressure," referring to a maximum of atmospheric pressure in two dimensions (closed isobars) in the synoptic surface chart, or a maximum or height (closed contours) in the constant-pressure chart. Since a high is, on the synoptic chart, always associated with anticyclonic circulation, the term is used interchangeably with anticyclone.

HIGHWALL. The unexcavated face of exposed overburden and coal in a surface mine or the face or bank on the uphill side of a contour strip mine excavation.

HORIZON, SOIL. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon. The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon. The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and, therefore, is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon. The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon. The weathered rock material immediately beneath the solum. In most soils, this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer. Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

HUMIDITY. (1) Generally, some measure of the water-vapor content of air.
(2) Popularly, same as relative humidity.

HYDRAULIC CONDUCTIVITY. The rate at which water of the prevailing kinematic viscosity will move through a cross section of unit area under a unit hydraulic gradient. The usual units in the United States are cubic feet per day per square foot under a hydraulic gradient of one foot per foot. Abbreviated to feet per day. Replaces the term "permeability."

HYDROLOGY. The science that relates to the occurrence, quantity, and quality of the water systems of the earth.

HYDROMETEOR. Any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface.

HYDROSTATIC STABILITY. Same as convective stability.

HYGROSCOPIC. Pertaining to a marked ability to accelerate the condensation of water vapor.

INDUCED EMPLOYMENT. Additional employment that is created by increases in employment in other sectors.

INSOLATION. Incoming solar radiation received by the earth.

INTERMITTENT STREAM. A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and is dry for a large part of the year.

INTRINSIC (Air Quality). Observed property of object without effect of intervening atmosphere (luminance, contrast).

INTRODUCED SPECIES. A species not a part of the original fauna or flora of the area in question.

INTRUSION. A feature (land, vegetation, or structure) which is generally considered out of context with the characteristic landscape.

INVADER PLANT SPECIES. Plant species that were absent in undisturbed portions of the original vegetation and will invade under disturbance or continued overuse.

INVERSION. (Also temperature inversion.) A departure from the usual decrease in temperature with altitude. An inversion layer refers to the layer through which this increase in potential temperature with height occurs.

INVERSION BASE. The level in which the increase in potential temperature begins.

INVERSION LAYER. A layer in the atmosphere through which the temperature remains constant or increases with altitude.

ISOBAR. Line or contour of constant pressure.

ISOPLETH. A line or contour drawn on a map denoting points having the same numerical value of an element; e.g., similar temperature (isotherm), pressure (isobar), or pollutant concentrations.

ISOTHERM. Line or contour of constant temperature.

JOINT (Geology). A surface of actual or potential fracture or parting in a rock, without displacement.

JURASSIC. The second period of the Mesozoic era, thought to have included the span of time from about 195-190 million years ago to 136 million years ago.

LANDSCAPE CHARACTER. The arrangement of a particular landscape as formed by the variety and intensity of the four basic elements of form, line, color, and texture.

LAND USE PLANNING. The development of plans for the uses of land that, over long periods, will best serve the general welfare, together with the formulation of ways and means for achieving such uses.

LAPSE RATE. The decrease of an atmospheric variable with height, the variable being temperature, unless otherwise specified.

LEASE AREA. The area or acreage of federal minerals within the project area. This is the acreage that would be leased. Different from public lands.

LIMB. The side of a fold. (See anticline and syncline.)

LIMITED MIXING DEPTH (LAYER). A mixing depth that is less than the maximum potential depth obtainable by solar insolation for a particular location.

LITHIC CONTACT. A boundary between soil and continuous, coherent underlying material which has a hardness of 3 or more (Mohs Scale). When moist, the underlying material cannot be dug with a spade and chunks will not disperse in water with 15 hours shaking.

LITHOLOGY. The description of rocks.

LOESS. Material transported and deposited by wind and consisting of predominantly silt-sized particles.

LONGWALL MINING. A method of underground mining in which large panels are first developed by mining openings around the periphery of the panel. The longwall equipment, consisting of hydraulic shields, pan conveyor, and shear or plow mechanism, is installed at one end of the panel and progressively mines out the entire panel. The roof caves immediately behind the hydraulic shields. Ventilation is maintained through the previously developed openings and across the mining face under hydraulic shields. The coal as mined falls from the longwall face onto the pan conveyors that then move it to a conveyor established on one side of the panel.

LOW. (Sometimes called depression.) In meteorology, elliptical for "area of low pressure," referring to a minimum of atmospheric pressure in two dimension (closed isobars) on a constant-height (closed contours) on a constant-pressure chart. Since a low is, on a synoptic chart, always associated with cyclonic circulation, the term is used interchangeably with cyclone.

MAXIMUM MIXING DEPTH. The maximum potential vertical depth of air that is available for the dilution of pollutant emissions. Maximum mixing depth is (1) a function of solar angle and intensity, which in turn is a function of the time of the year and geographic location, and (2) the surface composition of the earth at a particular location.

MECHANICAL TURBULENCE. Turbulence which results from the interaction of the wind flow with topographic features.

MEDIAN (geometric mean). The 50th percentile demarcation for a distribution.

MESOSCALE. Having characteristic spatial dimensions somewhere between 1 and 100 miles. Mesoscale phenomenon thus include the bulk of air pollution phenomenon, in addition to land and sea breezes, mountain winds, squalls, and thunderstorms.

MICRON. A unit of length equal to one-millionth of a meter or one-thousandth of a millimeter. The micron is a convenient length unit for measuring wavelengths of infrared radiation, diameters of atmospheric particles, etc.

MICRO-SCALE. In meteorology, having characteristic spatial dimensions of about 1 mile and less. Typical micro-scale phenomena include the retention of moisture by crops, etc.

MINE DRAINAGE. Any water forming on or discharging from a mining operation.

MINE FACILITIES. An area within the project area upon which all buildings and other facilities that are used for mine administration and coal processing or handling are constructed. It includes that portion of the access road and railroad spur (loop) that is within the project area.

MINE PERMIT BOUNDARY. See Project Area.

MINING AREA. The area within the project area that would be disturbed by mining operations. Includes haul roads.

MISSISSIPPIAN. A period of the Paleozoic era, thought to have included the span of time from 345 million years ago to 320 million years ago.

MIXING DEPTH. The volume of air that is available for the dilution of pollutant emissions.

MULTIPLE USE. Harmonious use of resources for more than one of the following purposes: grazing of livestock, wildlife production, recreation, watershed, and timber production. Not necessarily the combination of uses that will yield the highest economic return or greatest unit output. Synonymous with multiple land use.

NAAQS. National Ambient Air Quality Standard.

NOCTURNAL INVERSION. Surface-based inversion induced by the phenomenon of radiational cooling.

NON-BASIC EMPLOYMENT. Employment engaged in producing goods for local consumption.

NUCLEATION. Any process by which the phase change of a substance to a more condensed state (condensation, sublimation, freezing) is initiated at certain
loci (see nucleus) within the less condensed state.

In nature, heterogeneous nucleation is the more common. The loci are particles which exist in a different, almost invariably more condensed initial state than the condensing of freezing matter. It should be emphasized that the particles may be of the same substance as that which is changing state. Homogeneous nucleation occurs when the change of state centers upon loci which exist in the same initial state as the changing substance. In this case, the nucleation system contains only one component, and it is termed spontaneous nucleation.

NUCLEUS. In physical meteorology, a particle of any nature upon which, of the locus at which, molecules of water or ice accumulate as a result of a phase change to a more condensed state; an agent of nucleation.

NUMBER SIZE DISTRIBUTION. The frequency of occurrence of particles of various sizes in sample.

NUTRIENTS. Chemicals essential to the growth and reproduction of plants, algae, or bacteria are considered to be nutrient chemicals. The most commonly measured and those generally considered to be indexes to the growth-supporting
capacity of water are nitrogen and phosphorous.

OBSCURATION. (Also called obscured sky cover.) The United States weather observing practice, the designation for the sky cover when the sky is completely hidden by surface-based obscuring phenomena.

OPEN-PIT MINING. Surface mining, a type of mining in which the overburden is removed from the product being mined; or may specifically refer to an area from which the overburden has been removed and will not be filled.

ORDOVICIAN. A period of the Paleozoic era, thought to have included the span of time from 500 million years ago to about 430-440 million years ago.

ORGANIC MATERIAL. Material consisting of naturally occurring carbonaceous and biologically-derived substances; e.g., wood, bone, or feces.

OROGRAPHIC LIFTING. The lifting of an air current caused by its passage up and over mountains.

OROGRAPHY. That branch of geomorphology which deals with the disposition and character of hills and mountains.

OUTCROP. Coal which appears at or near the surface; the intersection of a coal seam with the surface.

OVERBURDEN. The earth, rock, and other materials that lie above a mineral deposit.

PALATABILITY. The relish that an animal shows for a particular species, plant, or plant part.

PARENT MATERIAL. The unconsolidated, more or less chemically weathered mineral or organic material from which the solum of soils has developed by pedogenic
processes. Horizon C of the soil profile.

PARTICULATES. Any liquid or solid particles suspended in or falling through the atmosphere.

PENNSYLVANIAN. A period of the Paleozoic era, thought to have included the span of time from 320 million years ago to 280 million years ago.

PERCHED WATER TABLE. The water table of a body of perched ground water.

PERENNIAL PLANT. A plant that normally lives 3 or more years.

PERENNIAL SPRING. A spring that flows continuously, as opposed to an intermittent spring or a periodic spring.

PERENNIAL STREAM. A stream or reach of a stream that flows continuously throughout the year and whose upper surface generally stands lower than the water table in the region adjoining the stream. Syn: permanent stream; live stream.

PERIOD. A unit of geologic time; the fundamental unit of the standard geologic time scale.

PERMEABILITY (Geology). The property or capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure. The customary unit of measurement is the millidarcy. Syn: perviousness. Adj: permeable. Ant: impermeability.

PERMEABILITY (Ground water). The rate in gallons per day at which water will flow through a cross section of one square foot area under a unit hydraulic gradient. Though still used by a few the term is obsolete (see hydraulic conductivity).

PERMEABILITY (Soil). The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

PERMIAN. The last period of the Paleozoic era, thought to have included the span of time from 280 million years ago to 225 million years ago.
of time from 280 million years ago to 225 million years ago.

PERSISTENCE. With respect to the long-term nature of the wind at a given location, the ratio of the magnitude of the mean wind vector to the average speed of the wind without regard to direction.

pH. The logarithm of the reciprocal of the hydrogen-ion concentration. Water is considered to be neutral at a pH of 7, acid if pH is less than 7, and basic if greater than 7.

PLANETARY BOUNDARY LAYER. (Also called friction layer, atomosphere boundary layer.) That layer of the atmosphere from the earth's surface to the geostrophic wind level including, therefore, the surface boundary layer and the Ekman layer. Above this layer lies the free atmosphere.

PLANT SUCCESSION. The process of vegetational development whereby an area becomes successively occupied by different plant communities of higher ecological order.

PLUME. The volume of air space containing any of the substance emitted from a point source. For practical purposes, the limits of a plume have to be arbitratily defined according to some minimum concentration of the substance.

PLUME RISE. The height attained by a plume from vertical momentum and buoyancy due to heat and molecular-weight difference of material released into the atmosphere. The behavior of this plume, the material contained in a volume of gas, will be influenced by chimney phenomena, surrounding buildings, terrain, as well as the velocity and buoyancy relative to the air and prevailing meteorological conditions.

POLLUTANT. Anything that pollutes; especially, any gaseous, chemical, or organic waste that contaminates air, soil, or water.

POROSITY. The porosity of a rock or soil is simply its property of containing interconnected interstices or voids. It can be expressed quantitatively as the ratio of the volume of the voids or interstices to the total volume of the rock, e.g., a rock or soil of 30% porosity would contain 0.3 interconnected voids and 0.7 solid rock.

PRECIPITATION. Any of all of the forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the ground. It is a major class of hydrometeor; but is distinquished from cloud, fog, dew, rime, front, etc., in that it must "fall"; and is distinguished from cloud and virga in that it must reach the ground. Precipitation includes drizzle, rain, snow, snow pellets, snow grains, ice crystals, ice pellets, and hail.

PREVAILING WIND. The wind direction most frequently observed during a given period.

PRIME FARMLANDS. Lands which have an adequate and dependable moisture supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks.

PROJECT AREA (or mine permit boundary.) The total area included with the boundary lines of site-specific maps. Includes public, state, and private lands.

PUBLIC LANDS. Any land and interest in land owned by the United States within the several states and administered by the Secretary of the Interior through the Bureau of Land Management, without regard to how the United States acquired ownership, except:

1. lands located on the Outer Continental Shelf; and
2. lands held for the benefit of Indians, Aleuts, and Eskimos.

QUATERNARY. The second period of the Cenozoic era, comprising all geologic time and deposits from the end of the Tertiary until and including the present.

RADIATIONAL COOLING. The cooling of the earth's surface and adjacent air, accomplished (particularly at night) whenever the earth's surface suffers a net loss of heat due to terrestrial radiation.

RADIATION FOG. A major type of fog, produced over a land area when radiational cooling reduces the air temperature to or below its dew point. Thus, a strict radiation for it is a nighttime occurrence, although it may begin to form by evening twilight and often does not dissipate until after sunrise.

Factors favoring the formation of radiation fog are (1) a shallow surface layer of relatively moist air beneath a dry layer and clear skies, and (2) light surface winds.

RADIOSONDE. A balloon-borne instrument for the simultaneous measurement and transmission of meteorological data. The instrument consists of transducers for the measurement of pressure, temperature, and humidity; a modulator for the conversion of the output of the transducers to a quantity which controls a property of the radio frequency signal; a selector switch which determines the sequence in which the parameters are to be transmitted; and a transmitter which generates the radio-frequency carrier.

RANGE. All land producing native forage for animal consumption, and lands that are revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. Generally considered as land that is not cultivated. In taxonomy, the area of areas throughout which a plant or animal taxon occurs.

RECEPTOR. Any person or piece of property upon which an air pollutant creates an effect.

RECHARGE. The processes involved in the absorption and addition of water to the zone of saturation. This does not include water reaching the belt of soil water or the intermediate belt. Also, the amount of water added.
Syn: intake, replenishment; ground water replenishment; ground water recharge; ground water increment; increment.

RECHARGE AREA. An area in which water is absorbed and eventually reaches the zone of saturation in one or more aquifers.

RECLAMATION. The process of returning disturbed lands to their former uses or other productive uses.

RELATIVE HUMIDITY. Generally, the relative measure of water vapor content in the atmosphere; precisely, the dimensionless ratio of the actual vapor pressure of the air to the saturation vapor pressure (usually given in percent).

RESIDUAL SOIL. A soil formed in material weathered from bedrock without transportation from the original location.

RESULTANT WIND. In climatology, the vectorial average of all wind directions and speeds for a given level at a given place for a certain time period, such as a month.

REVEGETATION. The reestablishment or improvement of vegetation through either natural or mechanical means, i.e., natural revegetation or artificial revegetation.

ROCK. A naturally formed aggregate or mass of mineral matter, whether or not coherent, constituting an essential and appreciable part of the earth's crust.

RUNOFF. That part of the precipitation that appears in surface streams that are not regulated; the streamflow unaffected by artificial diversions, storage, and other works of man in or on the stream channels. Works of man within a drainage basin but not in or on the channels, such as land management practices, may affect the amount of runoff from a given event, but the runoff is equivalent to streamflow. Streamflow is not equivalent to runoff when artificial works are in or on the channel.

SALINE SOIL. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

SALTATION. Soil particle movement in water or wind where particles skip or bounce along stream bed or soil surface.

SATURATION. The condition in which the partial pressure of any fluid constituent is equal to its maximum possible partial pressure under the existing environmental conditions, such that any increase in the amount of that constituent will initiate within it a change to a more condensed state. In ground water the voids of the rocks are completely filled with water.

SATURATION VAPOR PRESSURE. The vapor pressure of a system consisting of moist air in equilibrium with a plane surface of pure water or ice. Such a vapor pressure is a function of temperature only.

SCATTERING. (Also called scatter.) The process by which small particles suspended in a medium of a different index of refraction diffuse a portion of the incident radiation in all directions. In scattering, no energy transformation results, only a change in the spatial distribution of the radiation.

SCAVENGING. (1) Same as washout. (2) Chemically, the addition of a chemical to a mixture in order to remove an unwanted constituent or convert it to an acceptable form.

SEASONAL GRAZING. Grazing restricted to a specific season.

SEDIMENTARY ROCK. Rock, either consolidated or unconsolidated, formed by the accumulation of precipitated material that has been held in solution or suspension in a fluid medium or formed by the accumulation of clastic material that has been transported to its site of deposition by a fluid medium.

SHEET EROSION. The removal of a fairly uniform layer of soil from the land surface by runoff water.

SITE-SPECIFIC. A specific project area analyzed within the environmental statement.

SLICK SPOTS. Soil surface areas that are slick when wet due to a high concentration of alkali or of exchangeable sodium.

SOCIAL INFRASTRUCTURE. The underlying foundation or basic framework of the social organization (i.e., government, public service agencies, police department, businesses, etc.).

SOIL BIOTA. The animal and plant life of the soil; flora and fauna collectively.

SOIL PRODUCTIVITY. The capacity of a soil in its normal environment for producing a specified plant or sequence of plants under a specified system of management.

SOIL STRUCTURE. The combination or arrangement of primary soil particles (sand, silt, clay) into secondary particles, units, or peds. The secondary units or soil aggregates are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades, respectively.

SOIL TEXTURE. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse, fine, or very fine."

SOLAR RADIATION. The total electromagnetic radiation emitted by the sun.

SOUNDING. In meteorology, same as upper-air observation. However, a common connotation is that of a single complete radiosonde observation.

SOURCE. A point, line, area, or volume at which mass or energy is added to a system, either instantaneously or continuously. Conversely, at a "sink," mass or energy is removed.

Examples of sources in the context of air pollution are as follows: a smokestack is a "point source," a freeway or aircraft trajectory is a "line source;" and an entire city is a "plane source."

SPECIES COMPOSITION. The relative proportions of various plant species in the total cover on a given area. It may be expressed in terms of cover, density, weight, etc.

SPECIFIC STORAGE. The storage coefficient divided by the vertical thickness of the aquifer and any confining layers that may be present.

STABILITY WIND ROSE. Average atmospheric conditions based on short- or long-term meteorological data set of joint frequency, wind direction, wind speed, and atmospheric stability.

STABLE. Pertaining to the atmosphere or an atmospheric layer in the condition of static stability, i.e., an atmosphere whose temperature lapse rate and moisture distribution is such as to suppress the vertical exchange of air. (See convective stability.)

STAGNATION. With respect to air pollution, the persistence of a given volume of stable air over a region, permitting an abnormal buildup of pollutants from sources within the region.

STOCKING RATE. The area of land which the operator has allotted to each animal unit for the entire grazable period of the year.

STORAGE COEFFICIENT. The volume of water an aquifer releases or takes into storage per unit surface area of the aquifer per unit changes in head.

STRATIGRAPHY. The study of rock strata.

STREAM(S). Any body of running water, great or small, moving under gravity flow to progressively lower levels in a relatively narrow but clearly defined channel on the surface of the ground.

STREAMFLOW. Water flowing within a stream channel.

STRIP MINE. Refers to a procedure of mining which entails the complete removal of all material from over the product to be mined in a series of rows or strips. The material removed is replaced after the product has been mined leaving an approximate original contour.

STRIPPING. The removal of earth or non-ore rock materials as required to gain access to the ore or mineral materials wanted. The process of removing overburden or waste material in a surface mining operation.

STRUCTURAL BASIN. A general geologic term for a depressed sediment filled area usually surrounded by uplifted layers of older rock.

STRUCTURE. Any visible signs of displacement or deformation of the rock such as faulting or folding.

SUBLIMATION. The transition of a substance from the solid phase directly to the vapor phase, or vice versa, without passing through an intermediate liquid phase.

In physical and chemical literature, it is customary to regard as sublimation only the transition from solid to vapor, but meteorologists do not make this distinction.

SUBSIDENCE (Air Quality). A descending motion of air in the atmosphere, usually with the implication that the condition extends over a rather broad area.

SUBSIDENCE (Geology). Movement in which surface material is displaced vertically downward with little or no horizontal component.

SUBSIDENCE INVERSION. A temperature inversion produced by the adiabatic warming of a layer of subsiding air. This inversion is enhanced by vertical mixing in the air layer below the inversion.

SUBSOIL. The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the plowed soils (or its equivalent of surface soil), in which roots normally
grow.

SUBSTRATA. Layers lying beneath the soil solum, either conforming (C or R) or unconforming.

SUPERSATURATION. In meteorology, the condition existing in a given portion of the atmosphere (or other space) when the relative humidity is greater than 100%, i.e., when it contains more water vapor than is needed to produce saturation with respect to a plane surface of pure water or pure ice.

SUPPORT FACILITIES (or ANCILLARY FACILITIES). An all inclusive term used to cover all railroad spurs, access roads, power lines, conveyor systems, etc., that are constructed outside the project area.

SURFACE BOUNDARY LAYER (Also called surface layer, friction layer, atmospheric boundary layer, ground layer). That thin layer of air adjacent to earth's surface, extending up to the so-called anemometer level (the base of the Ekman layer). Within this layer the wind distribution is determined largely by the vertical temperature gradient and the nature and contours of the underlying surface; and shearing stresses are approximately constant.

SURFACE INVERSION. (Or ground inversion.) A temperature inversion based at the earth's surface; that is, an increase of temperature with height beginning at the ground level.

SURFACE MINING. Mining method whereby the overlying materials are removed to expose the mineral for extraction.

SURFACE RUNOFF. The runoff that travels over the soil surface to the nearest surface stream, runoff of a drainage basin that has not passed beneath the surface since precipitation. The term is misused when applied in the sense of direct runoff.

SURFACE WATER (Water). Waters on the surface of the earth, including water in streams, lakes, ponds, ice, snow, glaciers, etc.

SUSPENDED PARTICULATES (SP). Model-predicted pollutant concentrations attributable to mine impact alone--may be compared with Prevention of Significant Deterioration (PSD) regulations.

SYNCLINE. An elongate fold in the rocks that is concave upward.

SYNOPTIC. Refers to the use of meteorological data obtained simultaneously over a wide area for the purpose of presenting a comprehensive and nearly instantaneous picture of the state of the atmosphere.

TEMPERATURE INVERSION. A layer in which temperature increases with altitude. Normally the temperature decreases with altitude.

TERTIARY. The first period of the Cenozoic era, thought to have included the span of time from 65 million years ago to about 2 to 1 million years ago.

TERRESTRIAL RADIATION. Total infrared radiation emitted from the earth's surface.

THERMODYNAMIC (ADIABATIC) DIAGRAM. Any chart or graph representing values of pressure, density, temperature, water vapor, or functions thereof, such that certain physical laws are satisfied (e.g., Equation of State, First Law of Thermodynamics).

THRESHOLD OF CONTRAST PERCEPTION. The value of contrast that permits an object to be just barely seen.

THRUST FAULT. A fault having a dip of 45^{o} or less in which the overlying side appears to have moved upward relative to the underlying side.

THRUST PLATE. The upper plate of a thrust fault.

TOPOGRAPHY. The conformation of the land surface.

TOPSOIL. The original or present dark-colored upper soil (A horizon) that ranges from a mere fraction of an inch to 2 or 3 feet thick on different kinds of soil.

TOTAL SUSPENDED PARTICULATES (TSP). The combination of model-predicted pollutant concentrations attributable to mine impact alone with projected background concentrations to determine cumulative impacts--may be compared with federal and Wyoming ambient air quality standards.

TRANSMISSIBILITY. The rate in gallons per day at which water will flow through a foot width of aquifer under a unit hydraulic gradient. Though still used by a few, the term is obsolete (it is replaced by the term transmissivity).

TRANSMISSIVITY. The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of aquifer under a unit hydraulic gradient. The usual units in the United States are cubit feet per day per foot width of aquifer, usually expressed as square feet per day (replaces transmissibility).

TRAPPING. A condition such that an effluent diffuses rapidly below the base of an elevated inversion but is prevented by the stable layer from diffusing to greater heights.

TRICERATOPS. Any of a genus of large herbivorous Cretaceous dinosaurs with three horns, a bony hood, or crest and hoofed toes.

TRIASSIC. The first period of the Mesozoic era, thought to have included the span of time from 225 million years ago to about 195 to 190 million years ago.

TURBIDITY. The quality of opaqueness due to the presence of suspended material. It is commonly expressed in Jacson Turbidity Units (JTU). These units are roughly proportional to mg/l of suspended sediment: a range in JTU of 3 to 440 corresponds to a range in concentration of suspended sediment of about 5 to 1,000.

TURBULENCE. A state of fluid flow in which the instantaneous velocities exhibit an irregular pattern and apparently random fluctuations.

UNDERLYING LAYER. That part of the soil below the surface layer if no "B horizon" is present.

UNIQUE FARMLANDS. Lands other than prime farmlands that are used for the production of specific high value food and fiber crops. Examples of such crops are citrus, olives, cranberries, and vegetables.

UPWARPING. An uplifting of the central part of an area relative to its periphery.

UTILITY CORRIDOR. An area in which utilities (power lines, pipelines, telephone lines, etc.) and roads are concentrated.

VAPOR PRESSURE. (Also called vapor tension.) The pressure exerted by the molecules of a given vapor. For a pure, confined vapor, it is that vapor's pressure on the walls of its containing vessel; and for a vapor mixed with other vapors or gases, it is that vapor's contribution to the pressure (i.e., its partial pressure).

VEGETATION TYPE. A plant community with distinguishable characteristics.

VISIBILITY. In United States weather observing practice, the greatest distance in a given distance at which it is just possible to see and identify with the unaided eye (a) in the daytime, a prominent dark object against the sky at the horizon, and (b) at night, a known, preferably unfocused, moderately intense light source.

VISIBLE LIGHT. Electomagnetic radiation with characteristic wavelength between about 4500Å and 7200Å ($2Å = 10^{-8}$ cm), which is capable of causing a visual sensation directly.

VISUAL RESOURCE MANAGEMENT CLASSES. The degree of alteration that is acceptable within the characteristic landscape. It is based upon the physical and sociological characteristics of any given homogeneous area.

WASHOUT. The sweeping out of airborne particulates by rain or snow.

WATER TABLE. The surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere. Syn: water level, ground water level.

WATER-TABLE AQUIFER. Unconfined aquifer.

WATER SUPPLY. A source or volume of water available for use; also, the system of reservoirs, wells, conduits, treatment facilities, etc., required to make the water available and usable; often but not always equivalent to water resources.

WIND ROSE. Any one of a class of diagrams designed to show the distribution of wind direction experienced at a given location over a specified period. The most common form consists of a circle from which sixteen lines emanate, one for each compass point. The length of the line is proportional to the frequency of the wind from that direction.

YEARLONG GRAZING. Continuous grazing for a 12-month period or calendar year.

APPENDIX D

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